# CenterLine Pavement Field Raters Manual

Fall 2004

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# Preface

This document originated from a draft manual developed in the early 1990's by over 20 Washington State Local Agencies, through the NWPMS User's Group. Using this draft and over 18 years of experience (over 50,000 centerline miles of video and manual surveys) Measurement Research Corporation has refined this original manual to what is presented here. It differs from the current (1999) WSDOT Local Programs rater's manual in a few key areas and includes additional information (See the "2002 NWPMS/WSDOT Proposed Standard" or CenterLine Pavement Rating Index Manual). The primary differences include the severity definition for alligator, longitudinal fatigue cracking, patching, inclusion of utility patching, different naming for longitudinal crack types and some minor differences in how various distresses are defined and quantified. Many of these changes reflect requests made by the original authors (agencies), which were rejected or changed by the WSDOT in their review and publishing process. It also contains rigid distress rating methods and roadside inventory material. If you are using the CenterLine PMS software or if you wish to use your resulting survey to properly model maintenance and repair operations you should use this manual and its related definitions and procedures.

You are free to copy this manual or a copy of this manual is available on request from MRC. A copy is also included in the CenterLine PMS help system in both Acrobat .pdf and MS word file formats. A field (or smaller) version of this manual is also available. You are encouraged to use this manual as written, however, if your agency requires custom modifications or the development of a special rating manual, you are welcome to use this manual as a starting point and modify it and us it as your own. The only requirement is that you include an acknowledgement as to the origin of your manual and give MRC written credit for the source of your material.

MRC currently provides manual rating services for over 3000 centerline miles each year for Washington State Local Agencies using this manual. This includes both walking and windshield rating surveys.

This manual and/or its procedures has been used or is currently used by several Washington State Local Agencies. This includes the following agencies.

| | | |
|---|---|---|
| City of Bellevue * | City of Bellingham * | City of Bonney Lake |
| City of Bremerton | City of Cheney | City of Colville |
| City of Edgewood | City of Everett * | City of Federal Way * |
| City of Fife | City of Fircrest | City of Gig Harbor |
| City of Issaquah | City of Kenmore | City of Kent |
| City of Kirkland * | City of Lacey | City of Lake Forest Park |
| City of Lakewood | City of Lynnwood | City of Mountlake Terrace |
| City of Olympia * | City of Othello | City of Pullman |
| City of Puyallup | City of Redmond * | City of Renton * |
| City of Ritzville | City of SeaTac * | City of Seattle * |
| City of Shoreline | City of Spokane * | City of Spokane Falls |
| City of Sumner | City of Tacoma * | City of University Place |
| City of Vancouver * | City of Walla Walla | Fort Lewis |
| Pierce County * | San Juan County | Spokane County |
| Lincoln County | Ferry County | Douglas County |
| Snohomish County * | King County | San Juan County |

* These are some of the agencies that were involved in the original development of this manual. Several other agencies not listed here were also involved along with the UW, CRAB, WSDOT and AWC.

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# CenterLine PMS

## Pavement Distress Rating Field Manual
## Inspection Procedures and Guidelines

These inspection procedures offer a method of determining pavement condition by observing and recording the presence of specific types and severities of defects, or distresses in the pavement surface. The elements of pavement condition rating are as follows:

1. The type of defect.
2. The severity of the defect. How bad is it?
3. The extent to which the road surface is affected by the defect. How much distress is there?

There are several types of defects and several possible severities and extents for each defect. These are described and illustrated for flexible and rigid pavements in the following pages of this manual. For a more general discussion and details see Appendix A. See Appendix C for the abbreviated field notes. These notes should be carried with you or at least they should be easily accessible during all rating operations and especially during all QC work. Appendix B contains information on the roadside inventory and on how to fill out of the rating forms either manually or on the handheld PC. To study the details on how the various pavement scores are computed and a comparison of these different index calculations refer to the 2002 Proposed Index Standard presented to the NWPMS/WSDOT Index Committee or the CenterLine Pavement Index Manual.

This manual covers both walking/automated and windshield rating procedures.

### Walking/Automated Procedures

In general, a walking survey records extent data separately for each distress severity. Extent data is recorded as the actual area, length or count depending on the distress type and quantification procedures in use. Each distress is measured over the pavement area specified by the individual agency. This is either the full pavement area, a single lane or a small sample unit area (generally >= 10%). It is highly recommended that sample unit procedures not be used and that the full surface area be rated. This provides more accurate data that can also be used to better manage your maintenance operations as well as providing improved network modeling performance.

### Windshield Procedures

A windshield survey is done from within a moving vehicle by having an individual observe the pavement, (generally a single lane), while driving at about 10 to 15 mph. The individual distress severity is defined by the single predominate severity and extent is grouped into ranges to allow the rater to visually estimate the distress data more easily. The extent data is generally further grouped by quantifying your extents based on percent of wheel paths lengths in place of the actual area or length of distress. This provides data that can give reasonable network level modeling but in general it is not adequate for managing maintenance operations.

### Distress Definitions

The description of the distresses and their associated severities does not change between these two methods. However, the extent is based on discrete ranges and wheel path percentages and the predominate severity for the windshield method. While actual areas, lengths and counts and all three severities are recorded when using a walking distress survey. See Appendix C for a detailed breakdown of the walking and windshield severity and extent descriptions and quantifications for both rigid and flexible pavements.

# Flexible Pavement Distresses

## 1. Rutting and Wear

Rutting is a surface depression within the wheel path. Rutting results from a permanent deformation in any of the pavement layers or the subgrade. It is usually caused by consolidation or lateral movement of the materials due to traffic loads. When the upper pavement layers are severely rutted, the pavement along the edges of the rutted area may be raised. Usually, the rutting occurs gradually across the wheel path, reaching a maximum depth in the center of the wheel path. Ruts are most obvious after rainfall when they are full of water. Wear is surface depression in the wheel path resulting from tire abrasion. No differentiation is made between rutting and wear.

**Severity:** Is defined as the average depth of individual rut measurements, general taken at the center of the wheel path or as the visual average if manual measurements are not to be taken.

**Extent:** The extent of rutting is assumed to be the full length of the segment. Average the rut measurements taken over the full segment length. Use sags & humps for localized rutting (less than 50 to 60% of roadway surface is rutted). If less than ¼ inch do not rate rutting. When using automated equipment, include the maximum value and standard deviation along with the average/mean.

**Measure:** Take measurements in as many locations as is practical and average them or simply visually estimate the average. If estimates are used, collect the data to the nearest ¼ inch. Estimates are the preferred method primarily because of traffic hazards and the time involved in collecting the data. Sense the extent is assumed to be 100%, only the single (Low) severity level is entered or recorded. Rutting should no be rated if it is not visible with the human eye or if it is less than ¼". Even with specialized/automated equipment you may want to ignore rutting below this level.

## 2. Fatigue (Alligator) Cracking

Fatigue cracking is associated with wheel loads and is usually limited to areas of repeated traffic loading. The cracks surface initially as a series of parallel longitudinal cracks within the wheel path that progress with time and loads to a more branched pattern that begins to interconnect. The point at which several discontinuous longitudinal fatigue cracks begin to interconnect is defined as alligator cracking. Eventually the cracks interconnect sufficiently to form many pieces, resembling the pattern of an alligator. On narrow, two lane roads, fatigue cracking may form along the centerline rather than in the customary wheel paths. In parking lots, at intersections and on low volume roads it is common to have fatigue cracking outside of the wheel path.

Almost always, the pattern of the cracking (the longer dimension of the connected cracks) is parallel to the roadway or direction of vehicle travel. However, fatigue cracking occasionally occurs in a pattern transverse to the roadway direction because of poor trench compaction, settlement, or frost action. Pot holes and other occurrences of destroyed or missing pavement are accumulated as high severity alligator cracking and may also be noted in the comment area of the field form. Also, small patches within an alligator cracked are included as high level alligator cracking.

**Severity:**

**Low** Multiple branched inner connecting longitudinal discontinuous thin cracks with no spalling. Single and intermittent longitudinal cracks are recorded as the Longitudinal Fatigue Crack distress type, which is a separate distress type.

**Medium** Cracking is completely interconnected and has fully developed an alligator pattern. Some spalling may appear at the edges of cracks. The cracks may be greater than ¼ - inch wide, but the pavement pieces are still in place.

**High** The pattern of cracking is well developed. Spalling is very apparent at all cracks. Individual pieces may be loosened and may rock under traffic. Pieces may be missing and appear as though they could be easily removed. Pumping of fines up through the cracks may be evident. Include smaller failed pothole patches and failed edge patches which are surrounded by high level alligator cracking.

**Extent:** The extent of alligator cracking is measured in square units or as a percentage or area or wheel path.

**Measure** The area associated with each separate crack severity should be recorded.





HIGH ALLIGATORS

LOW ALLIGATOR

LOW ALLIGATOR

LOW ALLIGATOR

HIGH ALLIGATORS & SAGS

LOW ALLIGATOR

## 3. Longitudinal Fatigue (Alligator) Cracking

All Longitudinal cracks run roughly parallel to the roadway centerline. Longitudinal cracks associated with the beginning of fatigue (alligator) cracking are generally discontinuous, broken, and occur in the wheel path. Do not include cracks along the curb or gutter edge unless they are open (> ¼") or you are instructed to.

## 4. Longitudinal Non-Fatigue Cracking

Longitudinal non-fatigue cracks may be caused by a poorly constructed paving joint or from reflective cracks caused by joints and cracks beneath the surface course, including joints and cracks near the edge of the pavement and from underlying PCC slabs. These types of cracks are not load (fatigue) associated. Low severity non fatigue related longitudinal cracking may look very similar to low severity fatigue or alligator cracking; and care needs to be taken to separate these two distresses properly. High severity non-fatigue related longitudinal cracks can exhibit large amounts of localized fatigue cracking around the longitudinal crack. If this is wider than 6 inches on either side of the crack, rate it as alligator cracking, otherwise rate as high severity Longitudinal Non-Fatigue cracking.

**Severity:**

**Low** Cracks have very little or no spalling along the edges and are less than ¼ inch wide. If the cracks are sealed and the sealant is in good condition, they should be classified as Low Severity. If the seal has failed try to rate the original crack, this is true for all sealed cracks. If the original crack width can not be determined, rate the crack as seen within the sealant.

**Medium** Cracks have little or no spalling but they are greater than ¼ inch in width. There may be a few randomly spaced low severity connected cracks near the main crack or at the corners of intersecting cracks.

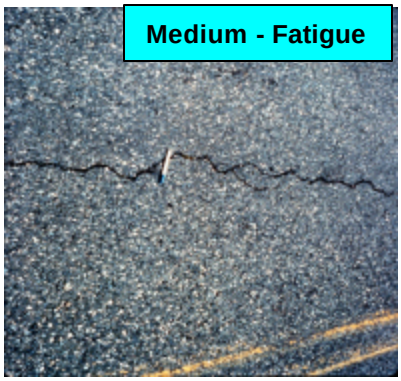
**High** Cracks are spalled and there may be several randomly spaced cracks near the main crack or at the corners of intersecting cracks. Pieces are visibly missing along the crack, or the two sides of the crack do not match. For longitudinal fatigue cracks, this longitudinal cracking will eventually form alligator cracking. If fatigue cracking is greater than 6 inches either side of the original non-fatigue longitudinal crack, rate this as alligator cracking otherwise rate as high level non-fatigue longitudinal crack.

**Extent:** The extent of longitudinal cracking is measured in linear units or as a percentage of segment length for one or both wheel paths.

**Measure:** The length of each individual crack severity should be recorded. For reflective cracks any associated fatigue cracks can be rated separately or included as high severity longitudinal cracks.

**Low - Fatigue**

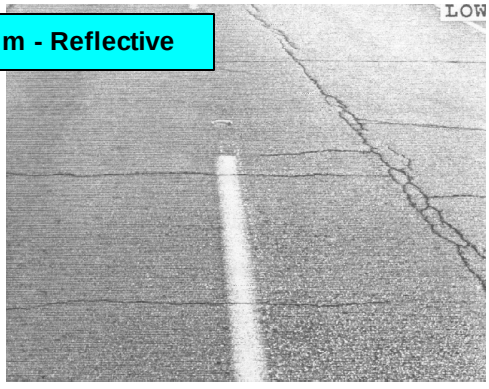
**Medium - Fatigue**



**High - Fatigue**

**Low – Sealed Construction Joint**

**Medium - Reflective**



## 5. Transverse Cracking

Transverse cracks run roughly perpendicular to the roadway centerline. They may be caused by surface shrinkage due to low temperatures, hardening of the asphalt, or cracks in underlying pavement layers such as PCC slabs. They may extend partially or fully across the roadway. Include cracks that may be the first stage of block cracking. Longitudinal non-fatigue cracks and transverse cracks receive the same score reduction and can be mixed or combined for convenience when rating shorter cracks. This is especially helpful for open cracks around patches.

**Severity:**

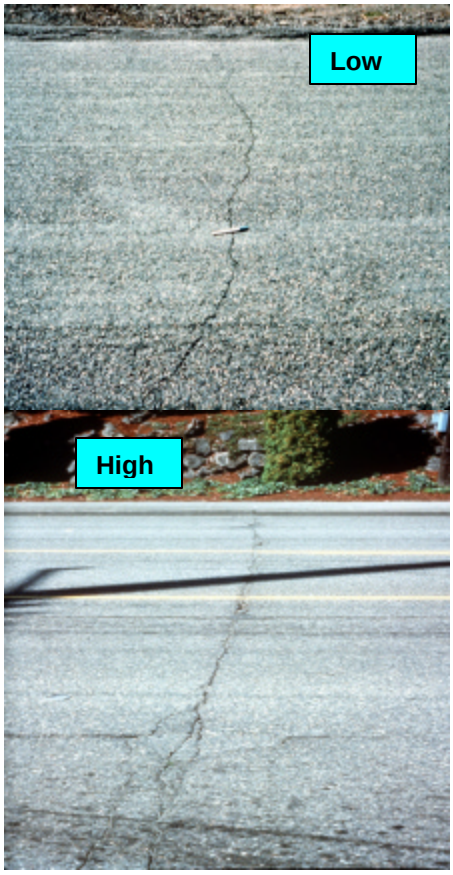
**Low** The cracks have very little or no spalling along the edges and are less than ¼ inch in width. If the cracks are sealed and the sealant is in good condition, they should be classified as Low Severity. If the seal has failed try to rate the original crack, this is true for all sealed cracks. If the original crack is not visible rate the crack in the sealant.

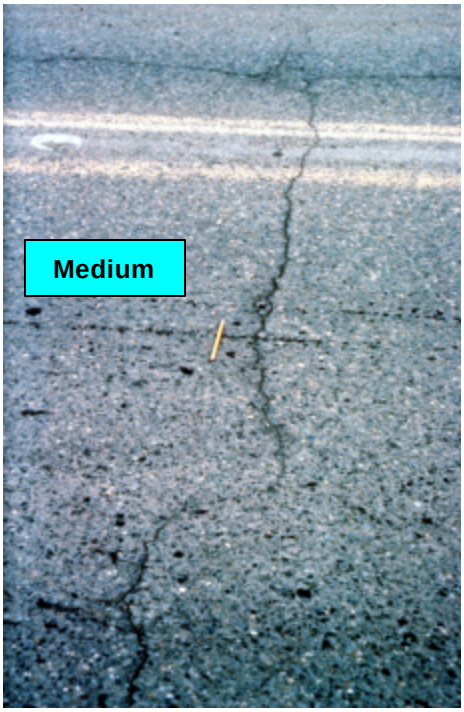
**Medium** The cracks have little or no spalling but they are greater than 1/4 inch in width. There may be a few randomly spaced low severity connected cracks near the main crack or at the corners of intersecting cracks.

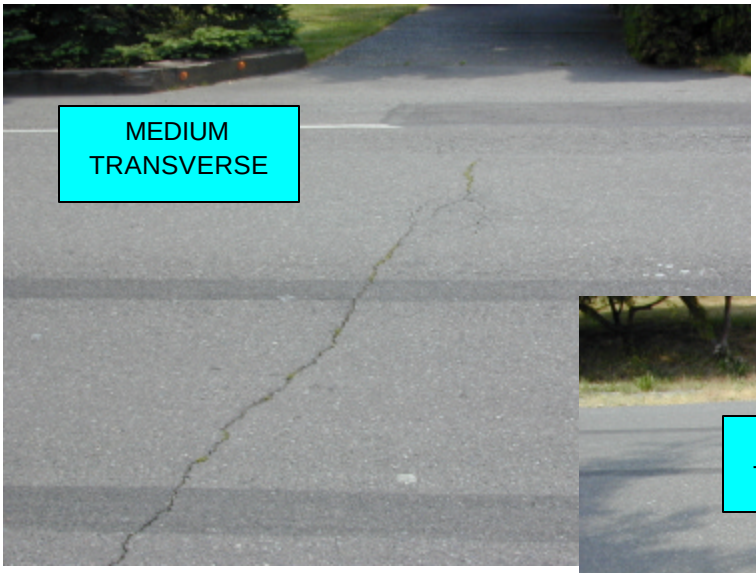
**High** Cracks are spalled and there may be several randomly spaced cracks near the main crack or at the corners of intersecting cracks. Pieces are visibly missing along the crack, or the two sides of the crack may not match.

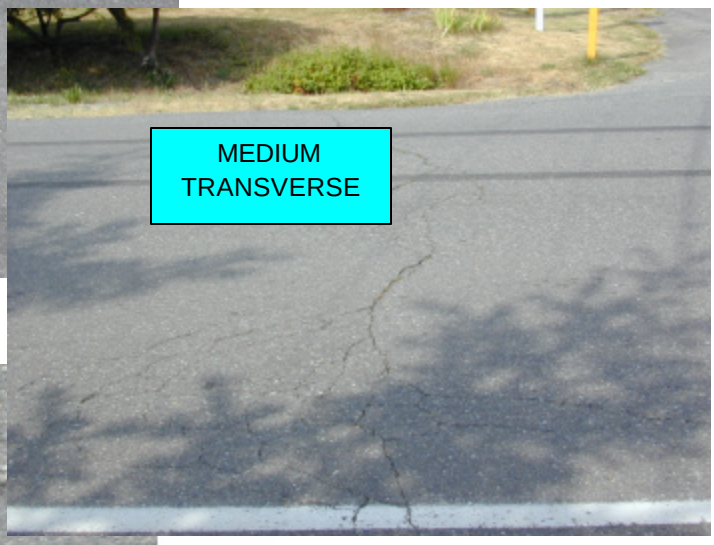
**Extent:** The extent of transverse cracking is measured in linear units or as counts per unit length. If using counts the crack should at least cross one wheel path before it is counted.

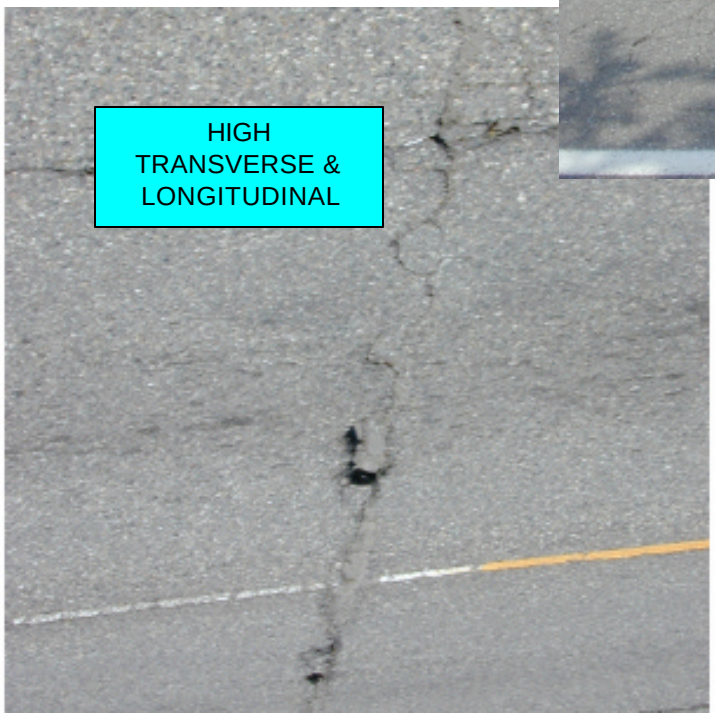
**Measure**: The length (or count) for each severity should be recorded. The actual length is preferred.




## 6. Raveling and (Aging or Weathering)

Raveling and aging are pavement surface deterioration that occurs when aggregate particles are dislodged (raveling) or oxidation causes loss of the asphalt binder (aging); aging is generally associated with raveling. An ACP pavement loses its smooth surface and begins to appear very open and rough like very coarse sandpaper. The severity is rated by the degree or amount of aggregate and binder loss. Rate the overall severity within the segment as the predominate level. This is an extremely important distress especially on low volume roads or roads that are failing for reasons other than structural (fatigue cracking).

This distress is measured or observed differently depending on whether the road surface is BST or ACP. Care should be exercised when rating chip sealed pavements as they tend to look raveled because of the inherent nature of the chip seal surface. However, raveling in chip sealed pavements (loss of aggregate)

actually results in a condition of excess asphalt that looks like flushing in ACP. However, it should be rated as raveling (see Flushing /Bleeding).

**Severity:**

| | |
|---|---|
| **Low** | The aggregate or binder has started to wear away but has not progressed significantly. The pavement appears only slightly aged and slightly rough. |
| **Medium** | The aggregate or binder has worn away and the surface texture is moderately rough and pitted. Loose particles may be present and fine aggregate is partially missing. |
| **High** | The aggregate and/or binder have worn away significantly, and the surface texture is deeply pitted and very rough. Fine aggregate is essentially missing from the surface, and pitting extends to a depth approaching one half (or more) of the coarse aggregate size. |

**Extent:** The extent of raveling is estimated and expressed relative to the total traveled surface area. The recommended ranges for estimated extent are given below; you may record areas or percentatges if this is what your agency wishs you to do.

| | | |
|---|---|---|
| **Localized** | **1** | Localized areas, usually in the wheel paths. |
| **Wheel Path** | **2** | Majority of wheel tracks are affected, but little or none elsewhere. |
| **Entire Lane** | **3** | Most of the lane is affected. |

**Measure:** The extent is generally recorded as 1, 2 or 3. For example 3L would be entered on the form for low level raveling over the full surface area. For entry into your Handheld PC, place the 3 into the low severity box. Record only the predominate severity. Therefore, on your PDA only one text box should contain data.



Medium – Entire Lane


High – Wheel Path


High - Localized

**HIGH RAVELING**

## 7. Flushing/Bleeding

Flushing and bleeding is indicated by an excess of bituminous material on the pavement surface which presents a shiny, glass-like reflective surface that may become sticky in hot temperatures. Wheel path refers to the tire tracking area. There are two wheel paths in each lane.

This distress is measured or observed differently depending on whether the road surface is BST or ACP. In BST pavements, loss of aggregate (raveling), commonly referred to as "chip loss," leaves the binder exposed. This condition looks like flushing, but is rated as raveling. It may be difficult to distinguish between raveling and flushing in BST pavements. Add comments to this effect if you are unable to determine the difference. For flushing on BST you will generally see rock that is covered or submerged within the asphalt.

**Severity:**

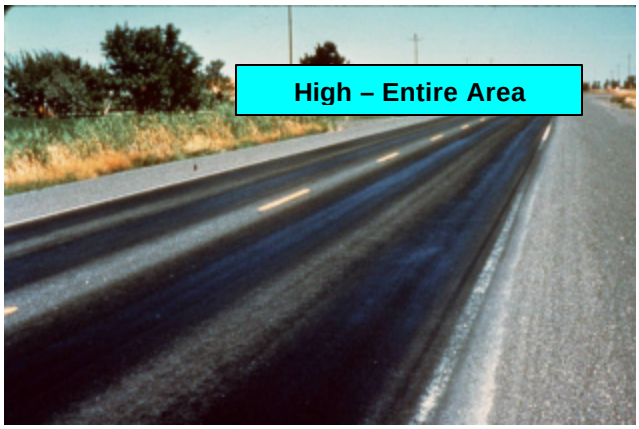
- **Low** Minor amounts of the aggregate have been covered by excess asphalt but the condition has not progressed significantly.
- **Medium** Significant quantities of the surface aggregate have been covered with excessive asphalt, however, much of the coarse surface aggregate is exposed, even in those areas showing flushing.
- **High** Most of the aggregate is covered by excessive asphalt in the affected area. The area appears wet and may be sticky in hot weather.

**Extent:** The extent of flushing is estimated and expressed relative to the total traveled surface area. The recommended ranges for extent are given below, you may record areas or percentages if this is what your agency wonts you to do.

- **Localized** **1** Localized areas, usually in the wheel paths.
- **Wheel Path** **2** Majority of wheel tracks are affected, but little elsewhere in the lane.
- **Entire Lane** **3** Most of the lane is affected.

**Measure:** The extent is generally recorded as 1, 2 or 3. For example 3L would be entered on the form for low level flushing over the full surface area. For entry into your Handheld PC, place the 3 into the low severity box. Record the predominate severity only.



## 8. Maintenance Patching

A patch is an area of pavement that has been replaced or covered with new material to repair the existing pavement or for utility access. A patch is considered a defect no matter how well it is performing. A patched area or adjacent area usually does not perform as well as the original pavement. When appropriately done repairs are an asset rather than a liability to the life of the pavement, however, the fact that they were required (other than for utility work) usually indicates some failure in the pavement structure. Some roughness is often associated with this distress. In general, a patch is less than a typical rehabilitation in size and less than full pavement length and/or width. Some agencies may have patches as long as the work defined by another agency as rehabilitation. Temporary patches are included in this distress category; however, a given agency may wish to include temporary patches in high level Alligator cracking. If a major portion of the segment has been re-paved, this is not a patch. Be sure to check with your supervisor as to how they want to rate their patches.

## 9. Utility Patching

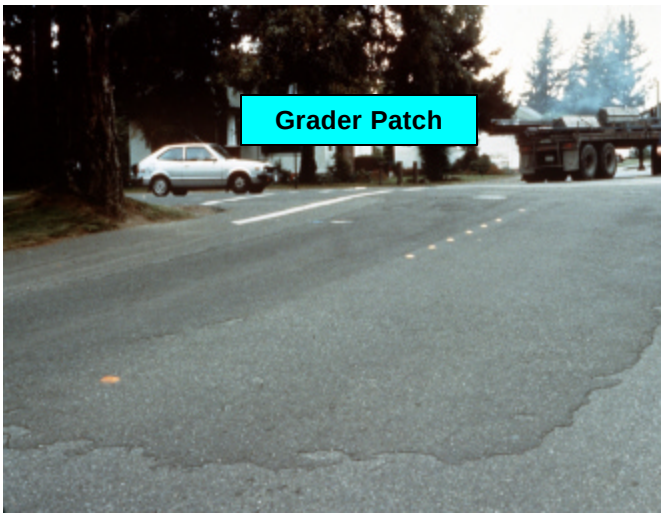
**Utility cut patches are rated and recorded separately using the same definitions given above**. Utility patches can be hard to distinguish from a full depth maintenance patch. However, if you consider the overall condition of the roadway (a maintenance patch is generally associated with a poor pavement), the location of obvious utilities near the patch (water, gas, power or telephone etc.) and your agencies patching practices, you can usually resolve the patch type. If you are unable to determine which it is always default to or use maintenance patching.

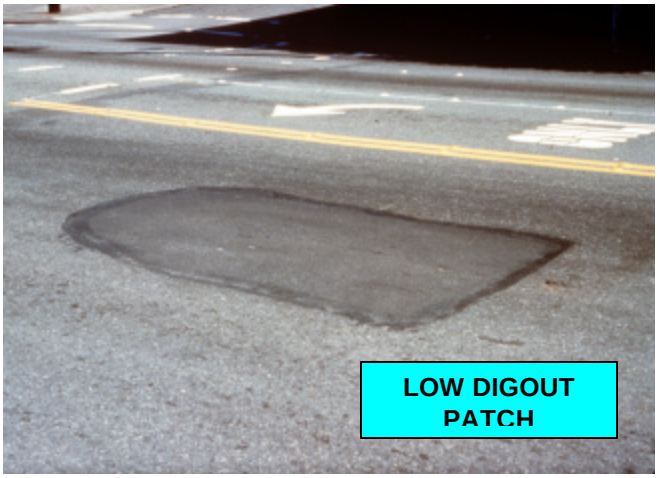
**Severity:**
- **Low** Patch has little or no distress of any type and no change in ride quality
- **Medium** Patch has medium severity distress of any type and/or moderately reduced ride quality
- **High** Patch has high severity distress of any type and/or severe reduction in ride quality

**Extent:** The extent of patching is measured in square units.

**Measure:** All other distresses (e.g., rutting, raveling, cracking etc.) are recorded within a patch as if the patch does not exist. Then rate the quality of the patch separately as to the amount of distress and any related deterioration to ride quality. The PMS software will account for any duplication in the quantification of this distress. Open cracks around dig out patches should be rated as longitudinal and transverse cracks. Do not rate sealed cracks in good condition around patches or sealed joints in good condition.

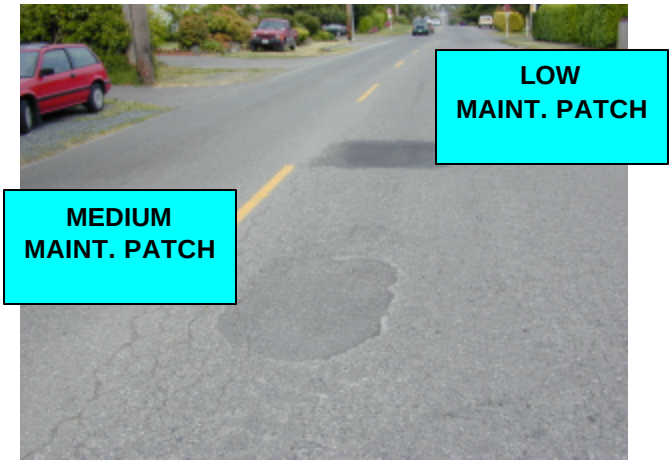

LOW MAINT.
PATCH


Grader Patch


LOW DIGOUT
PATCH


LOW MAINT.
PATCH


HIGH
MAINT. PATCH


LOW
MAINT. PATCH
MEDIUM
MAINT. PATCH

## 10. Corrugation and Waves

This distress category covers a general form of surface distress, which is not limited to the wheel path, although they may occur in the wheel path. The distress may occur in isolated areas, such as at intersections, curves, or on steep grades and may be associated with areas where vehicle brakes are being applied in anticipation of these features. It may also occur over a large part of the roadway surface. Corrugations and waves are regularly occurring transverse undulations, in the pavement surface. Corrugations occur as closely spaced ripples, while waves are undulations whose distance from peak to valley is more than 3 feet.

**Severity:** The severity of corrugation is defined as the maximum vertical deviation from a 10-foot straight edge placed on the pavement parallel to the centerline of the roadway.

| | |
|---|---|
| **Low** | 1/8 inch to 2 inches per 10 feet. |
| **Medium** | 2 inches to 4 inches per 10 feet. |
| **High** | Over 4 inches per 10 feet. |

**Extent:** The extent of corrugations is expressed in square units and is measured over the entire survey area.

**Measure:** Record the square units separately for each severity.

## 11. Sags and Humps

This distress usually occurs in isolated areas of the roadway surface. Sags and humps are localized depressions or elevated areas of the pavement that result from settlement, pavement shoving, displacement due to subgrade swelling, or displacement due to tree roots. Localized rutting, such as at intersections, is recorded as sags and humps. This distress is also a good place to record any distress or condition that does not fully comply with any of the other distresses. If this is the case, care should be taken to record any needed details in the comments section of the rating form.

**Severity:** The severity of sags or humps is defined as the maximum vertical deviation from a 10 foot or larger straight edge placed on the pavement parallel to the center line of the roadway.

| | |
|---|---|
| **Low** | 1/8-inch to 2 inches per 10 feet. |
| **Medium** | 2 inches to 4 inches per 10 feet. |
| **High** | Over 4 inches per 10 feet. |

**Extent:** The extent of sags and humps is expressed in square units.

**Measure:** Record the square units area for each separate severity.

## 12. Block Cracking

Block cracks divide the pavement surface into nearly rectangular pieces with cracks that intersect at about 90 degrees. Block cracking is caused principally by shrinkage of the asphalt concrete and daily temperature cycling. It is most commonly associated with colder climates. It is not load-associated, although load can increase the severity of individual cracks. The occurrence of block cracking usually indicates that the asphalt has hardened significantly through aging. Block cracking normally occurs over a large portion of the pavement area including non-traffic areas. However, various fatigue related defects may occur in the same segment. Block cracking always begins as equally spaced transverse cracks at 40 to 60 foot intervals.

**Severity:** The severity of block cracking is defined by the average size of the blocks.

- **Low** 9 X 9 feet and larger blocks.
- **Medium** Greater than 4 X 4 feet to 9 X 9 feet blocks.
- **High** 2 X 2 feet to 4 X 4 feet blocks.

**Extent:** The extent of block cracking is square units or percent of length.

**Measure:** Measure the typical size of the blocks and select the appropriate severity. Record the unit area.

## 13. Pavement Edge Conditions

Edge raveling occurs when the pavement edge breaks away from roadways without curbs or paved shoulders. However, edge conditions can still occur with paved shoulders and/or curbs. The crack between the curb or gutter is also included as edge cracking. Edge patching is the repair of this condition. The "lane less than 10 feet" distress indicates that the edge raveling has progressed to the point where the pavement width from the centerline to the outer edge of roadway has been reduced to less than 10 feet.

**Severity:** The severity of Pavement Edge Condition is defined as follows.

| | |
|---|---|
| **Low** | Edge Patching |
| **Medium** | Edge Raveling |
| **High** | Edge Lane Less Than 10 Feet – width to centerline < 10’ |

**Extent:** Actual length of edge failure. If both sides are fully raveled, this would be 200% raveling,

**Measure:** Accumulate the lengths along the surveyed lane for each type/severity of edge defect as it occurs. This can be recorded/estimated as actual lengths or the percent of length. This can result in up to 2 times the length segment or 200%.

**Edge Raveling**

**Edge Patching**

## 14. Crack Seal Condition – This is an inventory item and not a distress

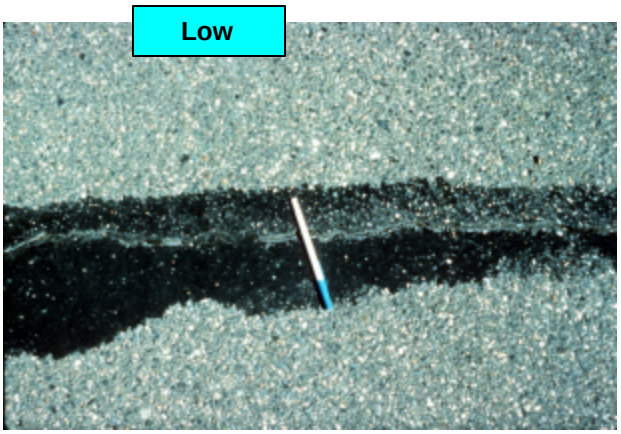
Inventory the condition of any existing crack (or joint) sealant. Crack sealant is generally poured over the surface of existing cracks to prevent water form entering the cracks. Some agencies route or dig out cracks prior to sealing them. This distress is, in general, an inventory of the existing sealed cracks and is used to manage a crack seal program. Crack seal condition is not used in the score calculations, only for crack seal maintenance management operations. If a crack is sealed properly and in good condition it is always rated as a low severity crack when you are rating the crack.

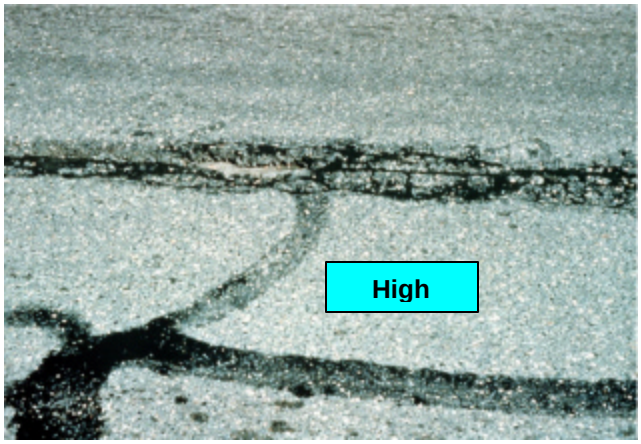
**Severity:**

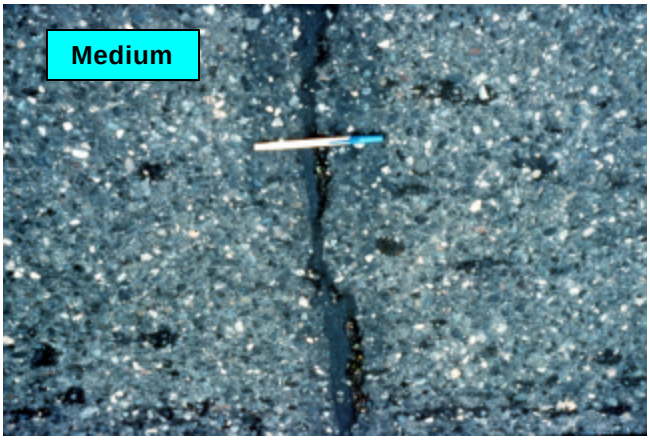
- **Low** Sealant in good to excellent condition.
- **Medium** Hairline cracks in the sealant allowing only a minimal amount of water to pass.
- **High** The sealant is severely cracked (or warn away) and may allow significant quantities of water to pass.

**Extent:** The extent of crack sealing is quantified as the percent of the total length of the cracks (or joints) in the segment that exhibit the seal condition being measured.

**Measure:** Estimate percent of the length of cracks and joints that exhibit each severity of seal condition. If you are monitoring this distress, transverse cracking should be measured in length units and not counts. The ratio of sealed crack lengths to actual (sealed + unsealed) cracks (alligator, transverse and longitudinal) should provide a true percentage of sealed cracks for a given section of pavement. When rating crack type distresses, a properly sealed crack is always rated separately as a low severity crack. If the crack seal has failed the crack should be rated using the actual severity if visible or use the crack width within the sealant.




# Rigid Pavement Distresses - Portland Cement Concrete Distresses

For distresses 1 though 6, enter the number of slabs that contain the given distress. Be sure to count the total number of slabs in the segment and include this on the rating form or your PDA. For blowups (#7) enter the number of occurrences and for the wear (#8) enter the average depth. If two slabs are associated with a single distress, such as faulting or pumping at joints between slabs, be sure to record this only once per slab.

## 1. Cracking

The cracking defects are irregular breaks that may form transversely, longitudinally, or diagonally within a (PCC) panel. Construction joints, which are straight and obviously formed or cut, are not considered cracks.

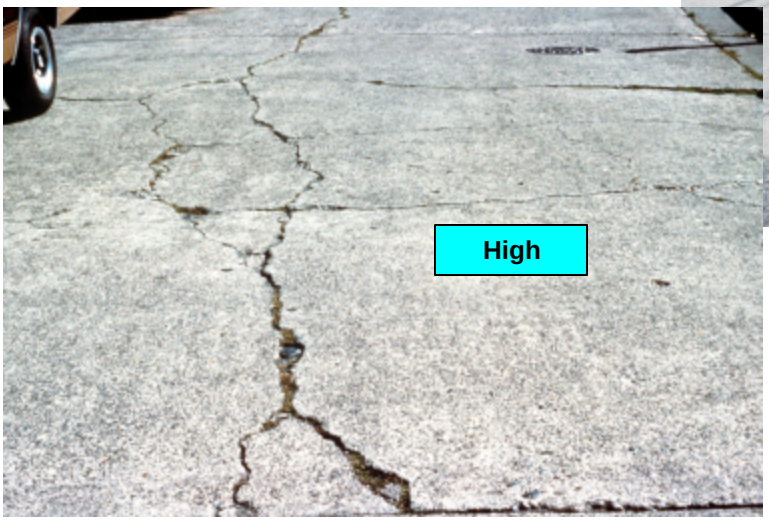
**Severity:**

The severity of the cracking is quantified by the number of cracks in a panel.

| | |
|---|---|
| **Low** | 1 crack per panel |
| **Medium** | 2 or 3 cracks per panel |
| **High** | 4 or more cracks per panel |

**Extent:** Number of slabs with this severity





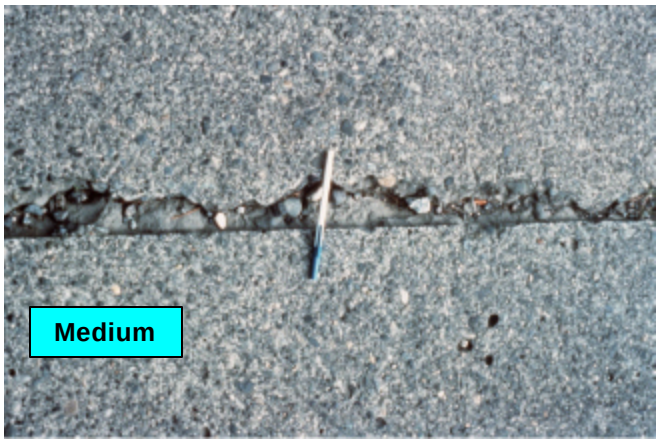
## 2. Joint and Crack Spalling

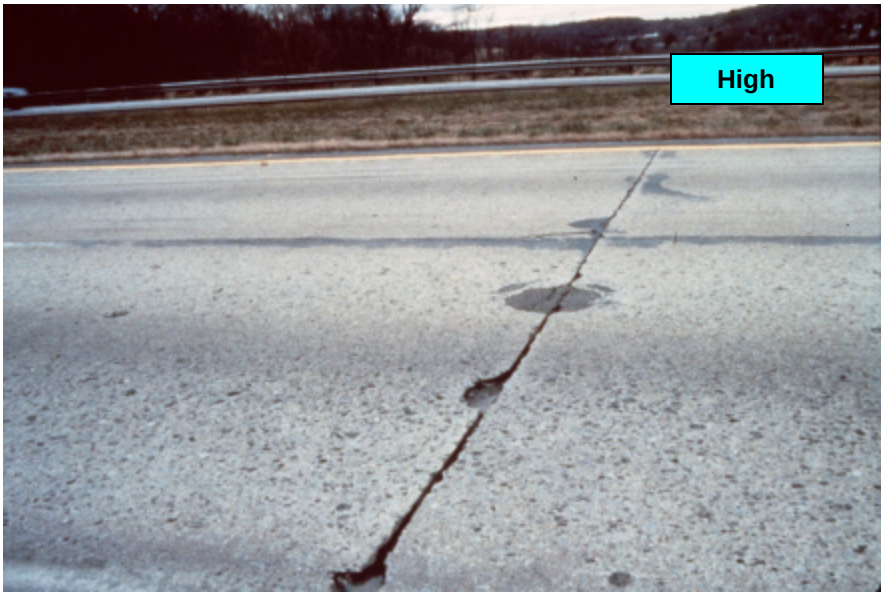
Spalling occurs when fragments break or chip off along the edges of the pavement joints or cracks. These spalls may be large wedges or flakes, or they may be only lost pieces of aggregate.

**Severity:** The severity of joint and crack spalling is quantified by the typical size of the spalls in the joints and cracks that are affected.

- **Low** 1/8-in. to 1-in. spalls.
- **Medium** 1-in. to 3-in. spalls.
- **High** Greater than 3-in. spalls.

**Extent:** Number of slabs with this severity.

## 3. Pumping and Blowing

Pumping and blowing refers to the ejection of water from underneath the pavement. Cyclic wheel loadings eject water through or along the transverse or longitudinal joints and cracks, or at panel edges. The ejected water also carries fine soil particles, thus eroding the pavement foundation. Pumping is recognized by the visible fine materials left on the dried surface of the roadway and/or shoulder areas. Because pavement rating is not done during wet weather, pumping activity would not generally be observed directly.

**Severity:** The severity of pumping is quantified by the type and amount of the evidence observed at each joint or crack. Either depression of the shoulder at the joint/crack or stains on the shoulder showing fine subgrade soil particles are evidence of pumping.

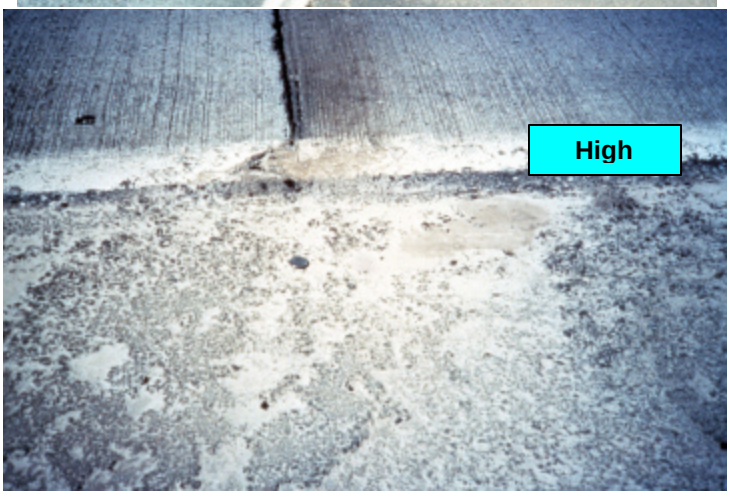
- **Low** Slight depression evident, little or no staining.
- **Medium** Moderate depression with obvious staining.
- **High** Severe depression and/or significant staining.

**Extent:** Number of slabs with this severity.

Low

Medium

High



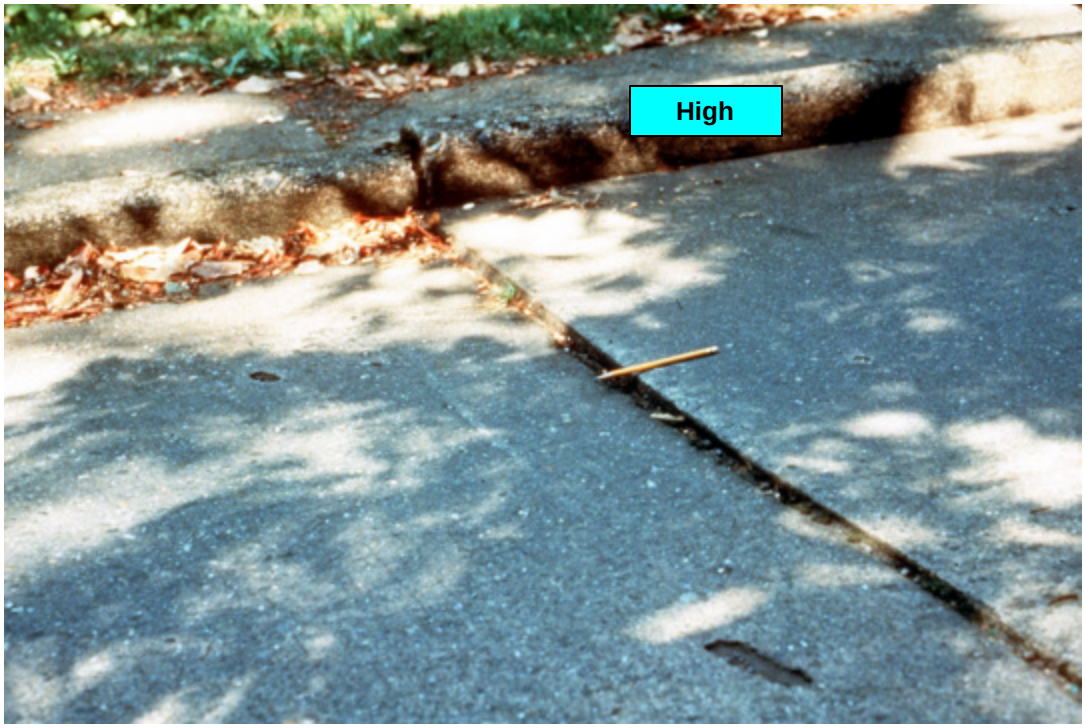
## 4. Faulting and Settlement

Faulting and/or settlement occurs when abutting pavements separate vertically at the joints or cracks caused by settling or uplifting. The result is a "step" difference between the adjoining pavement surfaces. Settlement is defined as differences in height between pavements across a longitudinal joint or crack. Generally, faulting will be found as a downward "step" across a transverse joint or crack in the direction of travel.

**Severity:** The severity of faulting or settlement is quantified by the vertical distance between panels or pavement surfaces.

- **Low** 1/8-in. to 1/4-in. faulting or settlement at joints or cracks.
- **Medium** 1/4-in. to 1/2-in. faulting or settlement at joints or cracks.
- **High** Over 1/2-in. faulting or settlement at joints or cracks.

**Extent:** Number of slabs with this severity.



## 5. Patching

Patching is a temporary or semi -permanent replacement of all, or part, of a (PCC) slab with a flexible or rigid pavement material. A new, full size , replacement slab is NOT a patch.

**Severity:**
- **Low** Patch is in good condition.
- **Medium** Patch shows slite to moderate distress and ride quality.
- **High** Patch shows severe distress and low ride quality.

**Extent:** Number of slabs with this severity.

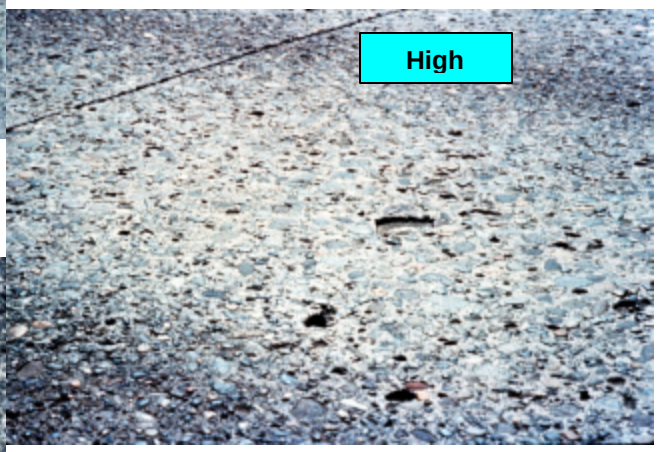
## 6. Raveling or Scaling

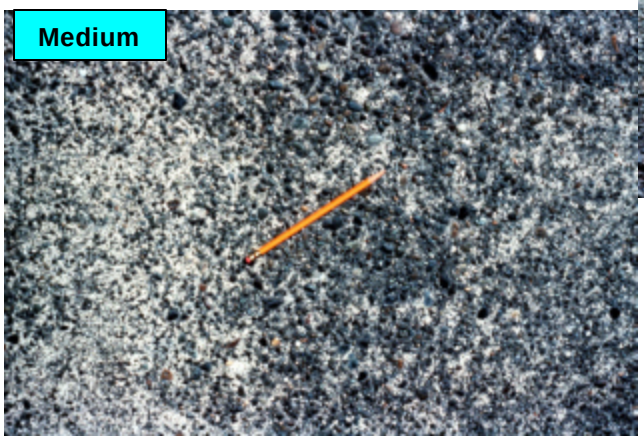
Pavement raveling or scaling is the progressive disintegration of the pavement from the surface downward, or from the edges inward, by the dislodgment of aggregate particles. In severe cases, the surface is very rough and irregular.

**Severity:** The severity of raveling or scaling is determined from personal judgment on the basis of the following descriptions:

- **Slight** The aggregate or binder has started to wear away but has not progressed significantly. The pavement appears only slightly aged and slightly rough.
- **Moderate** The aggregate or binder has worn away and the surface texture is moderately rough and pitted. Loose particles may be present and fine aggregate is partially missing from the surface.
- **Severe** The aggregate and/or binder have worn away significantly, and the surface texture is deeply pitted and very rough. Fine aggregate is essentially missing from the surface, and pitting extends to a depth approaching one half the coarse aggregate size or greater.

**Extent:** Number of slabs with this severity.

## 7. Blowups

Blowups are the shattering or upward bucking of pavement panels at transverse cracks or joints. The occurrence is caused by the expansion of a PCC slab when all available room for expansion has been previously taken and the PCC slab is tightly confined. The defect is seldom, if ever, observed in action, but the evidence is obvious. The rater will most likely find a patch where the blowup happened. Usually the patch will include parts of two or more slabs or even the full slabs which have been removed in adjacent lanes across the whole roadway. Raters must assure themselves that the patching was not for utility work or some other activity. The patch is also included in the patching category.

**Severity:** Not defined.

**Extent:** The number of occurrences in the segment are counted and recorded.

## 8. Wear

Wear is a surface depression in the wheel path resulting from tire abrasion (usually studded tires).

**Severity:** The severity is the average wear (rut) depth in the wheel path for the segment or sample. Automated systems may accurately record mean, maximum, standard deviation, and other useful data. Enter the average visual depth of the wear in the wheel path to the nearest ¼"

**Extent:** The extent of wear is assumed to be the full length of the segment.

# Appendix A

## Pavement Surface Condition Guide
## &
## General Discussion

# Appendix A

# Pavement Surface Condition Guide

## Introduction

Regularly scheduled pavement condition inspection is one of the most important steps in implementing and maintaining a comprehensive Pavement Management System (PMS). Such a system involves dividing the pavement network into logical segments, recording descriptive segment inventory data, and collecting pavement performance (distress) information relating to these segments. These processes provide the critical information needed for analysis to determine maintenance and rehabilitation requirements, project priorities, and to conduct long-term planning.

The purpose in performing pavement condition surveys is to document the progressive deterioration of each segment in the paved roadway network. For these data to be useful in a predictive way, consistency in locating, defining, observing, and recording the surface defects on a one to two year cycle is critical.

While many types of data might be collected, this procedure concentrates on defects that indicate progressive deterioration, particularly those that are associated with the pavements' strength or ability to support and carry traffic loads or which may trigger individual agency maintenance, repair and rehabilitation (MR&R) activity. In general, alligator (fatigue) cracking triggers action on heaver traveled roads while raveling and other environmentally (non-fatigue) related distresses tend to trigger actions on low volume and/or residential roads.

Each defect is classified and rated according to type, severity, and extent. In most cases three levels of severity are defined, and the extent is measured, or estimated, as the actual length or area (or as a percentage) of distress within the surveyed segment. A single deduct value for each combination of the predominate severity and range of extent is used in the windshield procedure; while for the walking procedure, continuous deduct curves are used and actual areas and lengths are accumulated for each severity level. In both methods these deducts are subtracted from 100 to calculate the final scores. Also, in both methods the same distresses and definitions are used.

WSDOT has developed a set of equations, which they and many of the Washington counties currently use to compute their pavement distress scores. It's called the Pavement Structural Condition Index (PSC). These equations are based on the same four distresses and underlying concepts included in the original WSDOT windshield rating method and they can be used with the WSDOT windshield discrete quantification procedures (WSPCR/$PCR_1$) by assuming fixed extent values or they can use the actual percentage of distress quantities (the extent) directly.

These equations are based on a concept of reducing all distresses to an equivalent level of alligator cracking. This concept does not have a sound physical foundation and there is weak correlation between the scores computed from these equations and previous rating score calculations (PCR, PCI, OCI etc.). Thus it is recommended that these equations and the resulting scores (PSC - Pavement Structural Index) be used for statewide comparison purposes only and that they not be used by local agencies for managing their PMS operations. Refer to the original WSDOT and CenterLine rater's manual and NWPMA Index Standard or CenterLine Rating Index Manual for more details. One other point, the WSDOT procedures, whether using the deduct matrices or equations, assume that the only longitudinal cracking you are to measure is low level alligator cracking, that all other alligator cracking is actually medium severity alligator cracking and that patching is high level alligator cracking, in other words the only distress they are really monitoring is alligator or fatigue cracking.

Transverse cracks are collected to help differentiate the eastern part of the state where freeze thaw plays a role. In other words this is a structural or fatigue index, which is reflected in the name given it following the switch to the equation method of calculation (PSC) from the original matrix method ($PCR_1$) by WSDOT.

The reason for discussing this is that unless this is exactly how you are collecting your data, this index is not valid or comparable between agencies. Unfortunately, most counties do not adhere exactly to the WSDOT definitions for collecting their data. The largest deviation from the original intent of the WSDOT is in the way patching and longitudinal cracking is interpreted. This has always been a problem for the local agencies and as a result the local agencies tend to collect their data the way they feel it should be done and in doing so negate the validity of the indices provided to them. WSDOT currently uses a video van to collect there distress data.

In 1996, the WSDOT develop another rating method (Streetwise) intended for use by the smaller agencies. This is a pencil and paper method, which uses a series of matrices containing actual distress score values, which are selected based on estimated distress quantities (extents). In this system only two distresses are used in computing the final score, alligator crack and the more predominate of the other distresses. The "other" four distresses include longitudinal cracking, transverse cracking, patching and raveling. The final index score is called the $PCR_3$ and is computed using a separate set of matrices developed specifically for this method. This means the WSDOT and its local agencies now have three different PCR indices and the PSC (or four completely different methods for rating and computing index scores), this does not include the WSEXT/OCI method presented in this manual and that was developed by the Washington State local agencies themselves.

For the walking distress survey (WSEXT) procedure, the actual extent of the severity of each type of defect is measured (or estimated), recorded, and used for developing the "Pavement Condition Score". The WSPCR windshield procedure uses discrete ranges of extent and the concept of predominate severity in order to facilitate easier and quicker visual windshield surveys, however, the resulting data is less accurate and of limited use for managing maintenance and repair work but is sufficient for network level PMS analysis operations. Automated survey techniques allow for relatively precise collection of data at a reasonable cost, the walking (WSEXT) procedure is designed to take full advantage of video distress data collection while still providing an optimal procedure for manual walking distress surveys. Automated procedures have not proven to provide reasonable data primarily do to repeatability problems. Even one of the most current (2000) laser based van's, which is considered to be state of the art, cannot resolve or detect crack widths less then 5 mm or about ¼ inch. This is completely in adequate for running your PMS; in that a pavement is completely failed by the time the fatigue cracks reach this stage of deterioration. Also, current automated equipment cannot measure raveling, flushing and many other distresses. Hopefully, future R&D will produce an automated system that will meet these needs.

When performing "Windshield Surveys" from a moving vehicle (car, bike etc.) it is recommended that the "Percent Wheel Path/length" along with extent ranges be used to quantify the extent data and that the concept of "Predominate Severity" be used to classify the severity of the distress. This approach can be used when performing a "Walking Survey" to help reduce the overall effort, however, it is recommended that when doing walking surveys that the WSEXT procedures be used. If implemented properly these procedures can be performed as quickly as the windshield procedures when estimates of extent are used.

## Objective of this Manual

The objective of this manual is to provide guidelines and definitions for identifying pavement distress types and defining the levels of severity (how bad) and extent (area, length, count) associated with each of these distress.

This manual is intended to be a training aid for pavement raters and as a field reference during the rating process. In performing pavement inspections, you, the pavement condition rater, should be able to identify each distress type and its level of severity and extent consistent with the descriptions contained within this manual.

## How to use this Manual

This manual provides the name, description, severity levels, and quantification process for each distress type that an agency evaluates in its pavement management program. The distress descriptions are separated into flexible or rigid pavement structural types. The definition of each distress type is followed by a description of its levels of severity, units of extent quantification, and measurement procedure. Its alright to exclude a given distress type if your agency does not wish to record it, just be careful to collect data on all distresses which influence your MR&R actions and planned use of your PMS. When necessary, additional comments and guidelines for evaluation may be included or provided.

Study this manual carefully before performing your first inspection and keep a copy close at hand during inspections to serve as a reference.

## Common Terms

To perform the inspection procedure, it helps to understand the following commonly used terms.

| | |
|---|---|
| PMS | Pavement management system. |
| Network | The roadway network is the complete system of roadways that make up the PMS database. It can be the complete roadway system or a subset, such as the arterials and collector streets (the more heavily traveled pavements). |
| Project | A project is the unit used to evaluate or group pavement segments. Projects are generally thought of as portions of roadway that could reasonably become funded improvement projects; however, they can be grouped together for various reasons. They generally consist of similar geometric data, such as pavement width, structure, and pavement type, or can be related to other needs, such as traffic volumes or planning needs. |
| Segment | A segment is generally a single block or other relatively short, homogeneous unit of roadway. Several segments may be included in a single project. They may vary in length for reasons such as pavement structure, behavior, and surface conditions or geometry. They may also vary to meet the objectives of the agency implementing the PMS. Smaller segment lengths provide greater flexibility in the growth and expansion of the pavement management system and in general allow for easier integration with GIS operations and other database related functions, such as long term budget and repair analysis.<br>These are generally the fundamental elements of the roadway network and thus define the PMS database structure or individual records or rows. All ratings are performed over or within each segment. All data within the PMS are linked or referenced to a given segment, and they are located in the segment or roadway network by the distance reference or milepost along a given street or road. |
| Pavement Type | This refers to the structural pavement type (flexible or rigid) as well as the actual pavement material type the pavement is constructed of. This includes Asphalt Cement Concrete (CAP), bituminous treated surfaces (BST) and Portland Cement Concrete (PCC). |

| | |
|---|---|
| Samples | Generally the WSDOT rating procedures involve summarizing and averaging the severities and extent of each defect over an entire segment. However, smaller multiple samples can be used for rating. This technique results in more than one rating value per segment and, if done using statistically correct sampling techniques, can help to reduce the rating effort, while still providing reasonable results. However, it is highly recommended that sample units not be used. Automated procedures will produce 100% sampling over the lane/s driven and the resulting data can be obtained in any sized samples or averaged over the entire segment. |
| Pavement Score or Index | This is a number computed from the pavement distress data. Deduct values (numbers) are assigned to each distress severity and extent via discrete matrices (windshield) or continuous curves (walking) depending on the rating procedure being used. These numbers are added together and subtracted from 100 to compute a final score. Previous WSDOT procedures used a discrete matrix based method of set ranges for defining the extent of each distress. The resulting index was called the "Pavement Condition Rating (PCR) Index". Current WSDOT procedures use a series of equations to compute a unique score. This score is referred to as the "Pavement Structural Condition Index" or PSC. Other systems use similar procedures to compute varies index scores. Separate indices can be defined for various parameters, such as, structural distress, non-structural distress, ride, skid/friction, roughness, NDT structural, drainage etc. The Overal Combined/Composite Index (OCI) is the most common index used in CenterLine. |
| Distress or Defects | Visual pavement surface distress or pavement defects can be quantified and related to the life cycle of a given type of pavement or roadway under given traffic and weather conditions. Each distress is generally associated with a specific pavement property, such as aging, wearing, fatigue, or material characteristics. These pavement surface defects can be distinguished and quantified visually by human or automated techniques, in contrast to non-visible defects that may relate to material properties, drainage, or other conditions. |
| Severity | The definition of severity for a given defect varies with each distress and is generally a measure of how badly or to what intensity a given defect has deteriorated. Examples are crack widths, crack deterioration or spalling, and loss of materials. |
| Extent | Extent is the measure of an area, length, or count associated with a given distress. It is how long and how far a given defect has progressed. All extents given in square units can be measured as a function of wheel path/length if desired. Wheel path measurements and predominate severity are recommended for driving windshield type surveys only. |
| Deduct | The deduct value is a number from 0 to 100 that is assigned to each severity and extent combination of a given distress observed in a pavement segment. A deduct value is assigned to each distress type and its various levels of extent and severity. The deduct value(s) for all distresses in a given pavement segment are summed together and subtracted from 100 to compute the final Rating Score for the segment. The WSDOT discrete rating method (WSPCR) uses discrete deduct matrices while the extended procedure uses continuous deduct curves. |
| Wheel Path | There are two wheel paths per traffic lane. If the lane is divided laterally into two equal parts, each half is considered one wheel path (even though the actual wheel path is only about ½ this with). Therefore, a two-lane roadway has four-wheel paths, which make up the full traveled surface area of a typical street, road, or highway. |

Predominant — The predominant distress severity is the distress condition that is most prevalent, or the typical severity. In general, if approximately equal portions of more than one severity exist, the higher severity should be used. If each severity of the defect is quantified and recorded separately, use of the predominant severity is not applicable. This is the method used in the WSEXT/OCI and PAVER/ASTM procedures. The predominate severity should always be used when doing driving windshield type surveys. It is also used for raveling and flushing in the WSDOT rating procedures.

Sealed Cracks — Sealed cracks in good condition are always rated as low severity. If the crack has reopened it should be rated as the actual crack severity if possible (visible) or if not, use the width of the existing crack within the sealant.

Spalling and Raveling — Spalling and raveling are commonly used terms that are associated with several defects. More general detailed descriptions are as follows:

**Spalling** is the deterioration of the sharp edge formed at the pavement surface along each side of a crack or joint. With severe spalling, pieces of pavement break away, causing the visual size or width of the crack on the pavement surface to be irregular and greater than the crack width below the surface. Large spalls may extend to full depth.

**Raveling** is the loss of material from the pavement surface. This may involve only small amounts of fine aggregate and/or binder; or it may involve larger pieces of the pavement at the edge of cracks or joints.

Rating Procedures - Refers to the actual field data collection operations. This includes the pavement surface distress definition and quantification procedures, and the severity and extent measurements. These procedures can affect or be an integral part of the rating computations.

Rating Computations - Refers to the method used to compute a score or index value from the data collected in the field. In this manual there are several different "Rating Computation" methods referenced. These are a result of WSDOT changing their method of computing their scores and from the adaptation of these procedures for use by local agencies. The following is a list of these procedures and related acronyms. The WSEXT method is covered in this manual and is recommended.

Rating System — A rating system or method includes both the rating procedures and rating computations. In the preceding manual a particular rating system, such as the WSPSC rating system, refers to the complete process of defining and collecting the field based pavement surface distress data and the computation of the resulting score/index values.

- $PCR_1$ — This refers to the WSDOT discrete matrix approach to rating pavements. The original index computed from this procedure was referred to as the PCR (Pavement Condition Rating). However, this procedure refers to the method of defining extent ranges, associated discrete deduct values and predominate severity and thus also refers to the WSPSC rating procedures when these methods are being employed. This is a windshield rating system.
- $PCR_2$ — This is an extension of the $PCR_1$ method, which includes additional distresses and modifications to the deduct matrix values. It was developed for use by local agencies.
- $PCR_3$ — StreetWise pavement Index – This is a completely unrelated index and rating system developed by WSDOT for extremely small agencies. This index has no relationship to any other index addressed here and should not be used under any circumstances.
- PSC — This procedure uses a series of equations developed by WSDOT for computing a pavement score. This index is only related to

distresses, which are a result of structural failure and is similar to the original PCR calculations in that it is limited to only four distress types. These equations can be used with the WSPCR procedures by assuming a fix or discrete extent mid-point value for each extent range or you can use the actual percent of area or length data directly.

WSEXT — Refers to the WSDOT extended rating procedure (OCI/CSI), which is a natural extension to the $WSPCR_2$ procedure. It uses the continuous PAVER/ASTM deduct curves where applicable. In this procedure, detailed data collection is used. Where applicable actual distress areas and length data are accumulated over each segment and stored by the PMS software. This is a more accurate procedure then the WSPCR and provides detailed data, which can be used for maintenance and repair planning and operations as well as a more accurate input for network level PMS use. This is a walking survey method.

PAVER/ ASTM/ MTC — These acronyms refer to a rating procedure developed by the US Army and Air Force and adopted by the APWA/ASTM and other organizations. An integral part of this system is the use of continuous deduct curves, which are used to compute the final index score. These curves are defined separately for each distress and for three levels of severity within each distress type. These curves are currently being used with the WSEXT procedure for all distress except raveling and flushing. The PAVER procedures are currently certified by the American Society for Testing and Materials (ASTM #D5340-98, 10-Jun-1998). This is the world's largest and most prestigious testing and certification organization. See the CenterLine Pavement Rating Index Manual for more detail.

Segment Inventory — This data defines the segment and includes the street name, from and to information, length, width, pavement type etc.

Roadside Inventory — This data refers to extraneous data associated with a given segment that includes curb & shoulder data, sidewalks, striping etc.

# Pavement Structural Types

## Flexible Pavements

A flexible pavement has little or moderate bending resistance. It maintains intimate contact with and distributes loads to the subgrade. (the material it is built on.) It depends on aggregate interlock, particle friction, and cohesion for stability.

ACP — Asphalt concrete pavement (ACP) is a mixture of liquid asphalt and aggregate. It is placed with a mechanical spreader and rollers, giving the finished product a smooth, dense surface with varying sizes of aggregate.

BST — Bituminous surface treatment (BST) includes various composite layered pavement treatments that may be applied over existing ACP or BST roadways, or are used to build up new roadway surfaces. They generally consist of uniformly sized gravel spread over a liquid asphalt layer, which solidifies when it cures. This process creates a thin structure with a very rough surface. Chip seals are the most common form of BST. Slurry seals (also a BST) consist of a premixed thin layer spread over the roadway surface which creates a smooth flat surface. Other seal coats include cape seals (a slurry seal over a chip seal), and fog seals.

## Rigid Pavements

A rigid pavement has a greater bending resistance than does a flexible pavement and distributes loads to the subgrade because of its ability to resist bending.

PCC Portland Cement Concrete Pavement (PCC) is a rigid pavement that is usually placed on a bed of gravel or other free draining material.

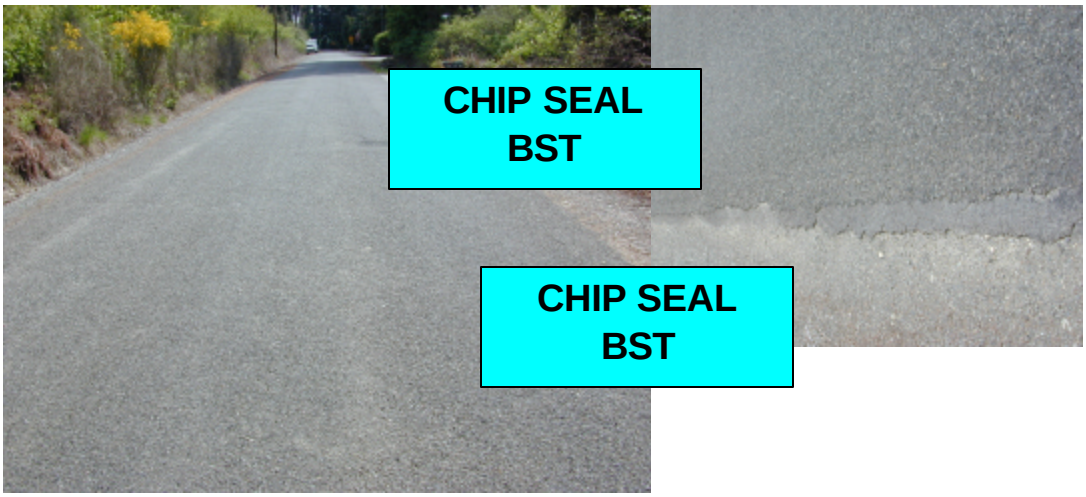
## Composite Pavements

APC Composite pavements are generally any of several combinations of rigid and/or flexible layers of mixed pavement types. The most common composite pavement is asphalt concrete (ACP) over Portland cement concrete (APC). Composite pavements are rated according to the top visible layer. The PMS database and software allows for special handling of composite pavements.

**ACP**

**PCC**

**MIXED**
**ACP & PCC**



CHIP SEAL
BST

CHIP SEAL
BST

SLURRY SEAL
BST

ACP OVER PCC
APC

## Inspection Procedures and Guidelines

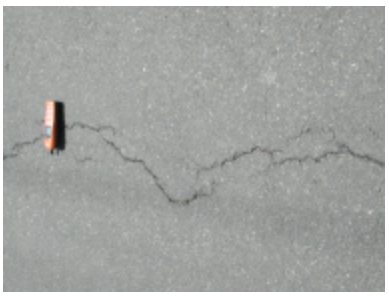
Note: The PAVER/ASTM procedures for rating PCC are preferred by some agencies as an alternative method for rating PCC streets. Materials for implementing these procedures are available from the APWA. The added level of detail associated with this method is not recommended or required. The WSEXT procedures which are present in this manual are adequate, especially in light of the fact that PCC streets have an extremely long life and have limited MR&R possibilities/options. Most agencies have little if any PCC and either remove or overlay when repairs are needed or they do individual slab replacement.

## Rating Considerations

Listed below are important factors to consider when collecting pavement condition data.

- A first decision is whether to use windshield, walking or automated surveys. A walking survey is the best and in general is less expensive than automated procedures. If funds are limited, consideration should be given to doing a walking survey on your arterial and collector pavements and a windshield survey on your residential streets. A survey should be done every two years at a minimum. Many of the urban agencies with high volumes of traffic do all their arterial and collectors and ½ of their residential streets every year. This provides current annual data and a consistent annual data on your arterials and a two-year cycle on the residential streets. But most important is that it provides for an annual consistent contract or budget. If you ask for funds every second or third year it is easy to loose interest or funding completely. This applies equally to an agency that does their own ratings and other PMS operations.
- Automated rating methods are not recommended and past experience has shown extremely poor and inconsistent results. Along with this, you have to make sacrifices such as you cannot rate raveling, crack seal is hard to get and patching is usually not possible or dependable. Future enhancements to automated equipment may address these short comings.
- Roads can be rated on foot or from a moving vehicle. In urban areas, rating is frequently done on foot. For driving surveys the best driving speeds for observing the defects range from 10 to 15 miles per hour. A single lane is generally used, but if time and funds allow measure more than one lane.

  **Note**: Different values will likely be obtained in walking vs. driving surveys and the agency needs to be aware of possible problems in using results obtained from more than one technique. Also, for network planning a simple 0 to 10 rating procedure can be adequate. Systems used by Oregon and New York State, which uses a series of photographs, can be adequate for some limited network/planning level decisions and operations or for minor important subsets of your system, such as your arterial streets.
- The relative sun angle and direction of viewing the roadway surface can greatly affect your visual observation. Be sure to view the pavement from more than one direction regularly during the survey to assure the true nature of the pavement surface is being observed (look both ways relative to the sun). The following two photographs were taken of the exact same section of pavement from opposite angles relative to the sun. This phenomenon is common and can be even more pronounce than shown below.



- The time of year and predominant weather (moisture and temperature) conditions over a given time period can also affect the severity and visibility of certain distresses. If at all possible, rate the roadway network at a similar time of the year for each survey and only while the pavement is dry. Some leeway is possible here, in that PCC and relatively new pavements can be rated when wet.
- When rating a roadway, you must observe the entire area of the traveled roadway segment (or sample) and determine the defect severities and extents over this full pavement surface area.
- When rating composite pavements, such as asphalt over PCC pavement, classify cracks that may correspond with the concrete joints as distresses and rate these and other cracks, as the type of crack they represent (transverse or longitudinal).
- When rating the width of cracks, use the average width, not the extremes. Cracks often vary in width and the intent is to rate the overall severity of the cracking when using ranges or the windshield method of predominate severity. If you're using detailed walking survey methods, group the crack sizes into their appropriate severities and record the area/length associated with each severity separately.
- Always rate sealed cracks, where the sealant is in good condition as low severity.
- Condition ratings apply only to the traveled paved surface of a road. If curbs are present you should rate from curb edge to curb edge, that is, include parking lanes. Do not include the conditions of shoulders or other adjacent areas. Shoulder condition, drainage information, or other items may be accounted for and collected separately from or with the pavement rating data. This will depend to some extent on each agency's policy; however, in most cases the full pavement area, including parking is rated when curbs exist. If it would be paved when rehabilitated, rate it. Also, check the length and width on the form and rate this area or note in comments if you have made other decisions while in the field.
- Areas within the curb returns are considered a part of the intersection for rating purposes. Intersections are generally rated with the higher functional class street or in a given direction. Intersections may also be rated and recorded separately. Each agency needs to develop its own policy. For streets with the same classification or if you are not sure, mentally draw an "X" between opposite corners and rate or inventory the pie shaped piece with the appropriate segment. See Figure 1 in Appendix B.
- When opposite sides of the roadway or individual lanes (automated measurements) are rated separately, you may use separate forms and enter the data into the database as separate multi-lane segments or add them together and enter as a single form/sample. If using PDA's always sum together and us the same form.
- When using printed forms and any type of defect is not observed, write an "N" in the first space on the field form for that defect. The "N" indicates clearly that a defect was not present and reduces the potential for confusion when the data are entered into the database.

## Quality Control & Rater Calibration

This is an extremely important component of the pavement rating procedures. Raters may work individually or as pairs and for larger agencies you may have several rating teams working at the same time. It is imperative that all these raters are rating consistently with each other during a given years survey as well as from year to year. The following is some basic guidelines to help insure that this happens. On a regular basis, have the raters do the following and compare results and make any necessary adjustments to the rating procedures being used by the individuals involved. In doing this use different colored forms for the cross checks so the manager can easily find and evaluate them. If you are using pocket PC's just have each rater put the data for the same segment/s in their units & compare the results while combining the final data or as needed.

- If the survey is conducted on foot, each rater should periodically walk a small subset of the same segments (or samples) as other raters and the results should be compared and corrections and discussion of the results should be made.
- The rating manager/supervisor should also make regular cross checks of all raters by evaluating existing rating forms and comparing them to their own ratings for pre-selected segments/samples.
- Some agencies prefer to use a common test section that is rated by each rater on a regular bases. However, experience has shown that the raters become familiar with this section and its use becomes less valuable the more times it is used. This approach also limits the variety of distress conditions needed to address the many different situations encountered in the field. However, it is an excellent training tool, especially when first starting.
- When selecting segments/samples for cross checking (quality control) be sure to select ones that contain representative distresses, hopefully, any distresses which you may have concerns with. There are a few key areas to watch out for. These include:

- How each rater is defining the low to medium and medium to high transition in longitudinal and transverse crack severity.
- Alligator or fatigue cracking severity transitions. It is common to see raters trying to apply the ¼ criteria from longitudinal and transverse cracking to alligator cracking. Also, the medium to high severity level transition is difficult.
- The severity levels and existence of raveling and flushing.

## General Notes

Other items that you should observe and correct or add to the rating form, if they are not present, are listed below. The extent to which this information is collected/edited may depend on your PMS manager and should be made clear to you before you conduct a survey.

- Verify the historical data provided; for example, segment limits and pavement surface type, width, and lengths.
- Previous years' rating data should be provided so that raters in the field can avoid making a poor choice if the severity or extent is a borderline judgment call. They may also detect and verify major changes or erroneous data from previous years. If bad data is found make notes to this effect in the comments.
- If new segmentation needs to be created, write a note to the PMS manager for review and creation. Make a new form reflecting the new segmentation and be sure to measure the lengths of each segment involved and to measure and/or collect all other pertinent data. When using handheld PC's just draw a line on the map (as accurately as you can) and a blank form will be presented to you. Be sure to save the form when completed.
- A segment break should be made at all intersections, at pavement type changes, changes in the number of travel lanes (not including turning lanes) and agency boundaries. Others may be specified by your agencies.
- You may be required to create new segments or samples if old ones are inaccurate or you find definite pavement condition breaks between existing segment boundaries. Beginning and ending points must coincide with original end points where applicable. Longer segments should be split into segments less than 1000 feet for small agencies and less than 2500 feet for larger agencies. Functional class and pavement type changes should also be considered.
- Measure pavement lengths to the center of the intersections. The pavement management system software will account for the overlap at the intersections automatically when computing lengths and areas.
- Bring to the PMS manager's attention the location of any potholes, utility trenches, street cuts, curbs, or sidewalks that you feel need immediate repair.
- Note any problems or concerns you may have in the comments.

Other considerations: The rater should check all existing data carefully and make any needed changes or additions to the existing data. All data on the top of each form is to be checked and/or filled in. Special requests may be made by a given agency, like re-measuring all pavement widths etc. However, in general lengths and widths should only be re-measured if current values are obviously in error. See Appendix C for details on how these data are measured or how the data is collected/interpreted.

## Comments for Managers/Supervisors:

Field rating work can be an extremely tedious job and care should be taken in selecting, training and managing your raters. Some considerations that may help are:

- Work raters in pairs or groups and have each rater walk and rate their own separate streets. If possible try to promote competition between raters while maintaining good quality control. This generally helps make the process more fun and relaxing while helping to maximize the amount of work being produced by each.
- It is important to allow all crews and individuals to work together and interact with each other and with their supervisor for the first few days and to some extent at different times throughout the rating season. This will help insure consistency in the data and will help establish a clear dialog between these individuals, so as to help them share their individual experiences and to bounce their opinions off of each other. Be sure to integrate this with your quality control operations.

- It can also be helpful to have a clear understanding in writing with your raters. MRC maintains a signed agreement with each of our raters and this agreement is the first issue of our initial training. A copy of this contract is included in the Appendices.
- Quality of the data collected and safety should always be the most important aspect of any rating operations.
- Allow each rater to take as much responsibility for how he or she performs their job as possible. Each rater will develop their own methods that work best for them. This should be promoted and acknowledged.
- If possible allow the raters to work whatever hours they wish as long as a minimum number of hours per week are met. This would be most applicable if the raters have to travel long distances to and from their work place during busy commute hours. Also, heavy traffic can make rating much easier on a weekend. You might also watch the time you rate the arterial roadways. These segments can have sustantually less traffic during mid-morning and mid afternoon time periods.
- Have the raters try to plan their rating operations such that the more heavily traveled streets are rated during mid-morning or mid-afternoon hours when traffic is a minimum.
- It may sound strange but a common safety related issue found in the field is bicycles. You are generally walking on the edge of the road where you are most likely to encounter them and they provide very little warning. However, the main point here is to always be as aware of what is going on around you as possible.
- Have your raters walk on the side of the road unless traffic is such as to allow walking on the roadway, such as your residential streets. Most Arterial and Collector streets are walked in both directions. If there are four or more lanes, have the raters do the best they can to see the inner lanes, however, do not have them go on the traveled surface if traffic is an issue.
- You should try to rate the full pavement surface area and not individual lanes. Maintaining confidence with individuals who will ultimately use the final data is difficult if only a portion of the roadway is surveyed. Invariably, if there is a problem in the future it will be with the area of the roadway which was not surveyed and use of you're your PMS will suffer.
- Provide instant access via cell phone to their supervisors for questions and help. Always be aware of the general area your raters are working and try to interact as much as possible with them. Two way radios can also be used.
- Provide initial and recurrent training as needed or as indicated by your quality control but never over do it. This can affect moral and productivity.
- If paper forms are used, proper clipboards are needed. Some raters prefer lightweight simple boards while others prefer more complex boards that open and hold extra forms and other materials. Make both available and let the rater decide what works best for them or their team. The weight of these clipboards is generally the most important consideration.
- The paper forms provided at the end of this manual for walking surveys provide an excellent tool for supporting your quality control. If the raters mark the direction, forward or reverse on the form you can walk a segment at a later time and see exactly what the rater saw and rated.
- Paper forms versus handheld PC's. The paper forms are a hassle to print, sort and enter data on, however, they provide the most accurate data and the best method for managing your quality control operations. However, the current technology provides an excellent alternative, with increased productivity and the elimination of manual data entry. One of the key things that seem to suffer from the use of a handheld PC is the amount and quality of the comment type data and the ease of making corrections and other notes on a paper form. The raters should be encouraged to edit any existing data and the file transfer software/ procedures should detect this and allow the user to interact with these changes. Current experience has shown that the raters tend to add more comment data and have little trouble with adding to segments to the Handheld PC map or editing existing map lines. Striaght database type data entry software is also available for you PDA device. This approach does

not provide the advantage of actually working with and editing the map but does provide an alternate approach.

- Windshield surveys – Two individuals should always be in the vehicle when performing a driving survey and care should be taken not to request to much data. Safety can be easily compromised if the driver has the possibility of being distracted. However, even with two people the driver must be able to help the data entry person to evaluate the data being collected. This process requires a much greater interaction between the two raters and care needs to be taken to help develop this interaction in the training and in the initial few weeks of operations. Exactly how the two raters share their responsibilities needs to be worked out among them. Generally, the driver will monitor transverse cracks and help in defining other distresses and the final extents, while the operator enters the data.
- When a pavement section is severely distressed with a large percent of the surface covered with patches and/or alligator cracking and other distresses and the pavement score is obviously going to trigger a reconstruct scenario, it is advisable to allow the raters to enter data that reflects their guess as to the percentage of the road which contains each of the distresses in questions. For example if there is about 45% of the surface that is patched in low condition and about 30% with high level alligator cracks, have them enter the data in accordance, (i.e. 45% low patching and 30% high AC) and have the data entry person calculate the actual area when entering the data. Tools are provided on the handheld PCs software to help in doing this.
- It is generally advisable to not have the raters do anything in the field that can be done by your data entry personnel. The fieldwork is highly dependent on good weather and is the more costly of the two operations and the data entry can be done at anytime. However, it is advisable to have your data entry people enter the data as it is being collected to allow for interaction between the fieldworkers and the data entry process and to help catch any abnormalities that my occur while the rating operations are still in progress. If the data is entered/imported some time after the ratings its easy to forget what was done or to not have the opportunity to correct problems.

# Appendix B

# Field Data Entry Form

# Reference Guide

# Appendix B

## Roadside Inventory & Distress Rating Data Field Definitions & Discussion

### Introduction

This application includes the entry and storage of pavement distress rating data along with general segment level roadside inventory data. All pavement distress types included in the WSDOT, StreetWise and MTC rating methodologies are included. The segment level inventory is quite extensive and includes curbs, shoulders, drainage, sidewalks and striping, only to name a few. The format associated with how all of these inventory data are collected is also orientated toward the use of this data for making pavement maintenance and repair strategy decisions. For example, if you have curbs or other structures which define pavement elevations or boundaries, this data is needed by the computer software for making the correct decision as to what needs to be done when an action is required. For more detailed attribute data associated with many of the inventory items included here, see the CenterLine individual point and intersection level data collection modules.

The roadway or segment definition refers to the data that defines or distinguishes one database record/row or segment from another (or line object in your GIS system). This includes the "on street id or road number", the "sequence or segment number", the "street name" and/or the "from and to information". The "from" and "to" information may include either the "from/to" descriptions or the "from/to" reference points (mileposts) or both. In general the Cities do not include from/to reference data and the counties always have the from/to milepost/reference data and in most cases the "from" and "to" descriptions as well. Intersection ID's, address ranges, cross street id's, etc. are also included for the discretionary use of the individual agency in defining or location information.

The roadside inventory refers to any physical inventory items associated with a given section of roadway or adjacent to the roadway. This includes sidewalks, curb & gutter, shoulders, wheelchair ramps, bike lanes, manholes, stripping etc. The following is a detailed description of the attributes that are included. You will obviously only need to collect data/attributes for the data items which you want or need. No one agency is expected to use all of the attributes included on the forms.

Segment ends/intersections: When inventorying items within or at the intersection always include all items or distresses with the higher functional classification (higher traffic) roadway. If the classification is the same for both streets or you are not sure mentally split the intersection by drawing diagonal lines between opposite corners (an X) and include everything within the appropriate area for the segment you are rating. If one street has a higher classification, in general you should rate the high class roadway through the intersection. All segment lengths are measured from center-of-intersection. These practices may vary from one agency to the next. See Figure 3x for more detail. Some rating systems use a small, generally 10%, sample size. In this case use the instructions associated with the system in use. If you use the sample unit approach you are limiting your ability to use this data for maintenance and other uses with vary little if any reduction in data collection costs. Generally, MRC does not do sample unit type surveys

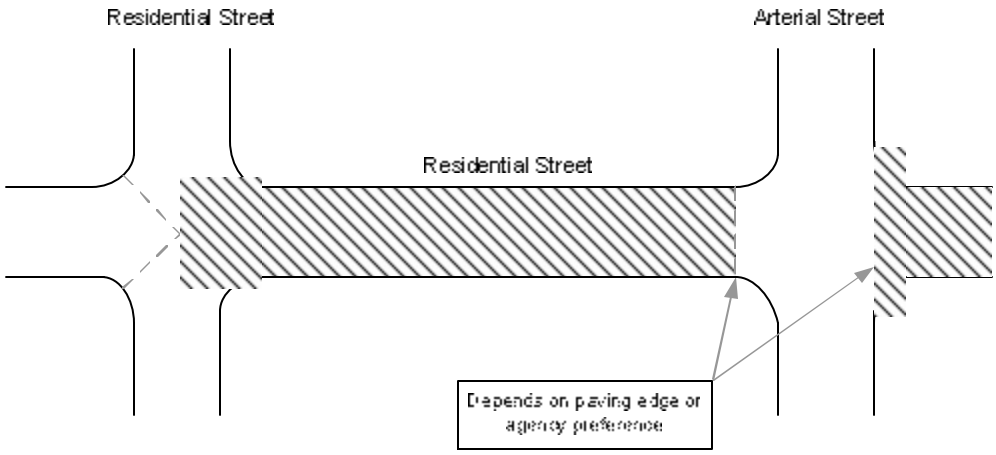



Figure 1 Rating segment/sample boundary definition

**Other considerations:** The rater should check all existing data carefully and make any needed changes or additions to the existing data. All data on all tabs on your pocket PC are to be checked and/or filled in unless instructed otherwise. Special requests may be made for a given agency, like re-measuring all pavement widths etc. However, in general, lengths and widths should only be re-measured if current values are obviously in error. The following is a list of these items and how they are measured or how the data is to be collected or interpreted.

The raters can carry a measuring wheel with them while rating (this should always be done during the learning phase) and they should always keep a copy of Appendices B & C from the CenterLine Pavement Distress Raters Manual with them at all times. This document and the CenterLine Raters Manual should be carried with each rater until they become familiar with all the data contained within them. However, these manuals should always be carried in your vehicle and easily accessible at all times. All distress extent measurements, such as lengths and widths, should be estimated and/or paced by the rater. Each rater should calibrate their individual pace by walking a known distance, this should be re-checked at regular intervals. Each rater is encouraged to develop his or her own methods and techniques for collecting data. Different things work better for different people. In general, you are encouraged to enter the dimensions or area associated with each distress quantity as it is encountered. However, some raters become quite adept at accumulating quantities for various distress severities and types in their head and entering them at random intervals. This type of activity is encouraged if the rater feels comfortable with it. Just remember, the quality and repeatability of your data collection efforts is more important then the quantity of data collected in a specified time period. Do not use a tape measure or other such device except when learning or instructed to. Another type of activity that helps some raters is to use some type of reference length, such as skip strip length, lane or pavement width etc. to mentally accumulate or measure lengths. The PDA software provides tools that allow the user to automatically enter multiples of the length, width or area. What ever works best for you is what should be used. It also helps to discuss what works for you with your rating partners and/or supervisor. It is also a good practice to have all raters carry a cell phone and to encourage them to call if they have any questions.

All of the data provided below should be checked carefully, and any necessary changes or additions made. Be sure to check the street names and try to make sure the lengths and widths look reasonable. You should only re-measure the lengths and/or widths if they are obviously bad or if instructed to do so, for a given agency. Be sure to check the pavement type. There should always be a segment break at the intersection of all agency owned non-exempt streets. To create a new segment, just add a new line to the map and fill in the pertinent data. If you have any questions please discuss this with your supervisor. You may also run into the need to combine smaller segments. This often occurs when the GIS map makes extra breaks when passing under freeway bridges and other structures. The best thing to do here is to use one of the small segments to enter your rating/inventory data and comment this and the other segments, indicating what you did and why or delete the ones not used. Always remember that someone will have to interpret what you've done at their desktop with no direct input other than what you've provided.

## Individual Data Items on the Pocket PC tabs

The following documentation defines each data entry object on each tab associated with the ArcPad data entry form used on the iPaq or other Pocket PC devise. See the first part of this manual for more detailed rating data, which is only outlined here. When entering data never use a comma ","; it will get interpreted as a new column when converting the final data file to an ASCII file for importing into the database. You should always check your import file for comma's prior to converting it to an ASCII (.csv) file. In general a slash "/" , dash "-" or semicolon should be used in place of the comma.

## Tab #1 – Identification tab #1 (I1)

### 1. Street or Route Number

This number is provided from the database and is always preprinted on the screen or the database listing. However, if new segments are created by splitting existing segments or for segments which need to be added to the database/map, this number will need to be added. The rater can let the database/rating manager add this number or it can be added in the field. If a current segment is being split, this will be the same number as the adjacent segment/s. If it is a completely new segment try to find the same street name on your database listing and use the same number. If it is not on this list, create a new number that would place the street in its proper alphanumeric order.

### 2. Segment or Sequence Number

This number, along with the on street number, uniquely defines the segment and its sequential order on the map. When assigning new numbers select a number which places the new segment in its proper sequential order within the "on street number group" for that street. Generally, these numbers are sequenced in a west-to-east and south-to-north direction or they will follow the address values.

### 3. Class

Pavement:

This is the functional classification of the roadway and will be provided unless other arrangements are made. The meaning of these numbers will change from agency to agency but in general will follow the designations given below. If it is obvious that a street classification is not correct, this should be noted in the comments. An example would be a roadway, which is specified as residential and you see heavy traffic on it or if the previous and following segments are the same but do not agree with the current segment.

| Cities | Counties # |
|---|---|

| | | |
|---|---|---|
| 1. | Arterial | Urban Principal Arterial |
| 2. | Major Collector/Arterial | Urban Major Collector |
| 3. | Minor Collector/Arterial | Urban Minor Collector |
| 4. | Residential (Collector)* | Urban Local Access |
| 5. | Residential* | Rural Major Collector |
| 6. | | Rural Minor Collector |
| 7. | | Rural Local Access |
| 8. | Others unique to each agency – ex. State routes, alleys, bridges, private etc. | |
| 9. | | |

# Counties have separate urban and rural classification systems

* Most Cities will only have one residential classification

### 4. Street – or Route Name

This is the full street/road name associated with the segment or map line you are currently on or working with.

### 5. From & To or End Points Description

This is the descriptive information associated with the termini of each segment. It should always be present unless instructed otherwise. Some counties have only mile posting with these two fields left empty. If this should be the case please discuss this with your supervisor. Enter the full proper cross street name or end of road acronym if the segment ends. The following are the recommended abbreviations for the end of road condition. If others are present within the database, try your best to stay consistent with them, however, if they are inconsistent use the following. If you have questions about this please discuss it with your supervisor. There is no consistency in the end of road type description between agencies and if you have questions or find inconsistencies within a single agency use the acronyms below. You should always edit this field if you find errors or if you are entering new segments.

| | |
|---|---|
| EORN, S, E, W | End of road north, south, east or west |
| CDSN, S, E, W | End of road north, south, east or west with a cul-de-sac |
| CTLN, S, E, W | City limits or boundary north, south, east or west |
| COLN, S, E, W | County limits or boundary north, south, east or west |

If cross streets within a given intersection have more than one name, include all names separated with a "/". This applies to the on street name as well.

Note: Where entering or editing street names always use the sample syntex as your find in the current database. Ex. "Av" or "Ave" or "AVE"

### 6. MP Fr – From Milepost or reference point

**A**lways measured at the intersection center.

### 7. MP To – To Milepost or reference point

### 8. SgLg – Segment or Section length

This is the segment length measured from the center of each intersection or to the actual end of pavement when the segment ends or terminate at a cul-d-sac. These numbers should be provided with the database unless the lengths need to be measured by the rater. Unless specified otherwise, this number need not be change unless the existing length is obviously incorrect. Use your wheel or the odometer in the Van to measure any questionable lengths.

### 9. SgWd – Segment width

This is the pavement width. It should include parking lanes if there are curbs, but not the shoulders if there are no curbs. Shoulder types and widths are specified in other fields on this form. In general, you should include the pavement surface area

that would be paved if an overlay were to be applied. This can vary from one agency to the next. If you have concerns or questions please discuss with your supervisior.

**10. Exempt**

If this field is set to "Y", this segment is exempted from the given agency's responsibility for maintaining this segment and unless instructed otherwise does not need to be rated. This is generally used for state routes, private roads etc. and is provided from the database. If what is observed in the field does not appear to agree with the above specifications, please note this in the comments

**11. Obser – Observer**

Enter/select your initials. **This is required before any other operations are possible**.

**12. Date ***

This is the date of the data collection operations, it is automatically entered when the Observer's initials are selected.

**13. Road # ***

County road log number – this can be the same as the Street or Route Number above. This field is intended to be used for the county Roadlog number. However, if it is not being used for this purpose it can be user defined and used for other data.

**10. Div ***

Division or zone – user defined

**11. Owner ***

Owner of this segment or roadway

**12. LMY ***

Last maintenance year or original construction year

* These items are under the keypad and are generally included for reference purposes only.

## Tab #2 – Identification tab #2 (I2)

**1. P Type – Pavement structural type (or management type)**

This is the pavement type as stored in the database. The actual surface type may differ. An example would be a chip or slurry seal over an existing ACP pavement. This is the type associated with how this segment is to be managed. Note in the comments if the underlying pavement type appears to be different from what is shown here. Also, see the next field, the pavement surface type. If you are unsure or if you feel that it is other than the options listed below, enter what you see into the comments, only the options shown below should be entered here. Refer to Appendix A for photographs of the different pavement types. If you find more than one pavement type within a single segment, they should be rated separately on separate forms. This is done by drawing a separate line parallel to the existing segment on the map and adding the on and sequence numbers along with the type and rating data.

| | |
|---|---|
| ACP | Asphalt Cement Concrete |
| APC | Asphalt Cement Concrete over Portland Cement Concrete |
| BST | Chip Seal |
| BSS | Slurry Seal |
| PCC | Portland Cement Concrete |
| BRK | Brick Surface |
| STN | Coble Stone Surface |

GRV Gravel of surface
DRT Dirt or natural soil surface

Note: If there is a decorative finish, such as a brick pattern, on the surface, add the appropriate acronym using a slash. For example, use PCC/BRK for a brick pattern stamped into a PCC pavement surface. Also, most modern or newer brick pavements will have a PCC underlying structure with sand base and with PCC curbs, if this appears to be the case, please note this in the comments.

### 2. P Surf – Pavement Surface type

This field is used to indicate the surface type of a given pavement. For example if an asphalt roadway has been seal coated to extent its life, this segment has a pavement type of asphalt (ACP) and its surface type would be BST. In most cases the pavement and surface types are the same and in this case leave this field blank.

### 3. BikeLn – Bike lane/s

Enter a "L", "R" or "B" if present on the left, right or on both sides of the roadway. Some agencies use "Y" or "N" (or blank).

### 4. Cast – Number of castings

Count the total number of castings in this segment. A casting is defined as any object, which has been placed into the pavement which would have to be accounted for (raised) when placing an overlay. This would include the following:

Values Covers
Monuments
Catch Basins & Gratings – if they extend into the pavement
Manholes, Etc.

### 5. Lighting

Enter a "Y" if street lighting is present or enter the number of lights

### 6. Lanes

This is the number of traveled lanes. You should include turning lanes if they run the full length of the segment, but not if they are just at the intersections. Do not include parking lanes.

### 7. Median

Is there a median on this segment – Y/N or enter the width or see Pierce County definitions in Appendix E.

### 8. Striping

If the street has markings or striping this is entered here. The following is a list of acronyms to be used. Enter all that apply to a given segment, separated by a slash. For example, CSK/CSD/FG-R/CX-F would indicate both a skip and solid centerline with a fog line on the right side only plus crosswalk striping at the from intersection.

| | |
|---|---|
| CSK | = Alternate or skip type centerline |
| CSD | = Solid centerline |
| CDD | = Double centerline |
| LSL | = Lane separation lines |
| FG | = Fog lines |
| BT | = Buttons |
| TRN | = Turning lane markings |
| CX | = Crosswalk |
| PD | = Passing double lane |
| LC | = Line color |
| F | = From intersection |
| T | = To intersection |
| SP | = Speed bumps |

| | |
|---|---|
| TR | = Turning circle-pedestrian protection |
| R, L, F, T B | = Right, Left, From, To or Both sides of roadway only, use a dash "-" to separate from associated acronym. |
| Blank | = No striping |

### 9. Comments

Enter any desired information, which you feel the agency or MRC should be made aware of. If these comments are related to issues that need attention you should call or make your supervisor aware of them. Always include the current year with your comments. For example, 2003 – New overlay. You can remove any existing comments if you wish.

## Tab #3 – SW - Sidewalks

### 1. Sidewalk Type left and right - SwTpLt/Rt

Enter the surface type of the sidewalk or trail. Enter PCC, CAP, BST, GRV or DRT



### 2. Sidewalk width left and right - SwWdLt/Rt –

This is the sidewalk width to the nearest foot

### 3. Sidewalk % Competed left and right - SwCmLt/Rt -

Percent of segment with sidewalks. This is recorded separately for each side.

### 4. Trees in or next to sidewalk - SwTrLt/Rt

Is there trees in or along side of the sidewalk (Y/N) or you can enter the number of trees on each side of the roadway. You may also wish to indicate if the sidewalk is part of the curb or it there is a planting strip on either of both sides of the sidewalk.

### 5. Sidewalk condition left & right - SwCdLt/ Rt

Rated using a score of 1 to 3, with 3 being the best. A 1 indicates a hazard to pedestrians. Check with your supervisor to be sure this data is to be collected for a given agency and as to the actual way in which the data is to be recorded. Some agencies use a 1 to 5 (or 1 to 10) score range.



6. **Sidewalk offset from curb - SwOffLt/Rt**
   Offset distance from the curb or shoulder line to the inside edge of the sidewalk. The offset from the roadway centerline could also be used.
7. **Parking - Park Lt/Rt -**
   Enter "L", "R" or B (left, right or both sides of roadway). Do not enter unless actual parking space is present and obviously intended. If asked to specify parallel or angle parking add a P or A.

## Tab #4 – DN – Drainage - Curbs, Shoulders & Curb Ramps

1. **Shoulder or Curb type - SdTpLt/Rt**

| | |
|---|---|
| V | Vertical Curb only |
| VG | Vertical Curb with gutter |
| RC | Rolled or Extruded PCC Curb |
| TE | Rolled or Thickened edge ACP |
| PV | Paved shoulder - ACP or BST |
| GV | Gravel |
| DR | Dirt |
| N | No shoulder or curb |

   Note: If more than one curb/should type exists with in the same side of a segment enter both options with a slash between them and specify in the comments. Example: VG/N & be sure to include the % curb completed data.
2. **Shoulder Width - SdWdLt/Rt**
   This is the shoulder width to the nearest foot. In general this would be measured from the pavement edge to the beginning edge of the ditch, if a ditch exists. In many cases this can be hard to determine, just use your best judgment or call for help.
3. **Minimum remaining curb height - CbHtLt/Rt**
   Estimate the minimum remaining curb height to the nearest inch. Only applies if curb exist.
4. **Curb Completed - CbCmpLt/Rt**
   Enter the percentage of the segment that has curb for each side of the roadway.
5. **Drainage Type or Storm System - DrTpLt/Rt**
   This can be recorded as open or close (existing or not) or as to the type of drainage system. Generally the open & closed method is used with windshield type data collection and the more detailed with walking surveys. If there is any type of catch basin system this would be considered a closed drainage system.
   Open of Closed drainage

| | |
|---|---|
| O | Open ditch or nature drainage |
| C | Closed drainage – catch basins & storm sewer system |
| | - or – |
| CBG | Curb with grate - closed drainage |
| CG | Curb without grate - Open drainage |
| DH | Open ditch |
| N | No drainage |
| CLV# | Culverts in this segment, where # = number of culverts |

   Note: If more than one drainage type/structure exists with in the same side of a segment enter both options with a slash between them and specify in the comments. Example: DH/CLV#
6. **Ramped Curb - FrRmpLt/Rt -**

Ramped curb/s at the “From” end of the segment. Only include the curb ramps, which are associated with the direction of travel for the segment you are collecting data on. See diagram below.

| | |
|---|---|
| Y | = Non ADA approved ramp. |
| ADA | = ADA approved ramp. |
| Blank or N | = No ramp. |
| AC | = No ramp but access is still available |

### 7. Ramped Curb Type - ToRmpLt/Rt -

Ramped curb/s at the “To” end of the segment.

| | |
|---|---|
| Y | = Non ADA approved ramp. |
| ADA | = ADA approved ramp. |
| Blank or N | = No ramp. |
| AC | = No ramp but access is still available |

Note: Curb ramps should only be included with the appropriate segment. The following graphic shows how to inventory curb ramps with the segment/s. If there is only one centrally located curb ramp include this with both segments but place a “/C” after the “Y” or “ADA” ex. ADA/C. Special or additional instructions may be provide for a given agency. Also, if intersections are being inventoried and/or rated separately, you should include the ramps with the intersections only, unless instructed differently.

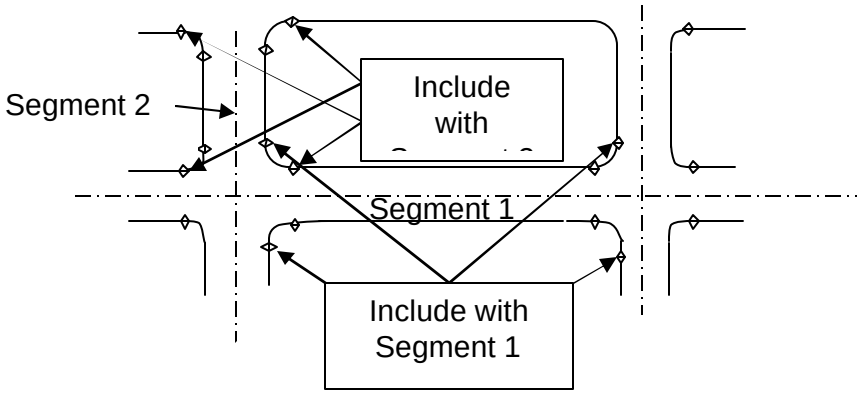



Figure 2 Curbed Ramp Inventory Methods

# Distress Data Tabs

This section contains short form reference materials for the distress data available on the Streets Field Data Collection Application forms. The WSEXT walking distress survey procedure is recommended and provided here. However, other methods currently in use are included. See the main part of this manual for full details on the individual distresses and how the data are collected. These other methods include the WSDOT Windshield method, StreetWise, PSC and the MTC. The following is a Summary for Manual Walking Surveys showing each pavement distress type and its quantification in terms of severity (how bad the distress is) and extent (over what area/length does it exist).

The data forms will automatically switch between the flexible and rigid distress types. If you are rating a flexible pavement use the flexible types and if you are rating a rigid pavement use the rigid distress types. By changing the "Type" on Tab #2, you can change distress types displayed on the form from flexible to rigid or in reverse. You will have to close the form and reopen it to change to the proper form. The following is a list these distress information as seen on the data forms.

Common field locations in CenterLine rating data tables

| | Text on Form | Flexible Distress | | Rigid Distress |
|---|---|---|---|---|
| 1 | Rutting/Wear | Rutting | 8 | Wear |
| 2 | Alligator/PCC Cracks | Alligator Cracking | 1 | Cracking |
| 3 | Long. Crack - Structural | Long. Crack - Structural | | |
| 4 | Long. Crack / Joint Spalling | Long. Cracking Non-Struc. | 2 | Joint Spalling |
| 5 | Transverse / Pump (PCC) | Transverse Cracking | 3 | Pumping & Blowing |
| 6 | Raveling / Scaling | Raveling | 6 | Scaling |
| 7 | Flushing / Blowups | Flushing | 7 | Blowups |
| 8 | Maint. Patch / PCC Patch | Maintenance Patching | 5 | Maintenance Patching |
| 9 | Utility Patching | Utility Patching | | |
| 10 | Corrugation | Corrugation | | |
| 11 | Sags / Faulting | Sags & Humps | 4 | Faulting |
| 12 | Block Cracking | Block Cracking | | |
| 13 | Edge Condition | Edge Condition | | |
| 14 | Crack Seal | Crack Seal | - | Crack Seal |
| 15 | Ride Quality | Ride Quality | - | Ride Quality |

Figure 3 Table of distress types and classifications

# Flexible Pavement Distresses

See Appendix C and the main body of this guide for details on how to enter the following data.

## Tab #5 - D1 – Distress Tab #1

1. Rutting and Wear - Use only the low level data input box on the form,.
2. Fatigue (Alligator) Cracking
3. Longitudinal Cracking - Fatigue Related Cracking
4. Longitudinal Cracking - Non-Fatigue Cracking - Joint Reflective and Construction Joint

## Tab #6 - D2 – Distress Tab #2

5. Transverse Cracking
6. Raveling
7. Flushing or Bleeding
8. Patching – Maintenance

## Tab #7 - D3 – Distress Tab #3

9. Patching – Utility
10. Corrugations and Waves
11. Sags and Humps
12. Block Cracking

## Tab #8 - D4 – Distress Tab #4

13. Edge Condition
14. Crack Seal Condition
15. Ride Quality
16. LYM – Last Maintenance/Construction Year
17. LOCI – Last Pavement Distress Index value
18. LYR – Year of last rating/OCI

# WSEXT Rigid Pavement Distresses

## Severity and Extent Summary for Manual Walking Surveys

The following is a summary of each pavement distress type and its quantification in terms of severity (how bad the distress is) and extent (over what area/length does it exist). In distresses 1 through 6, extent is defined as the number of slabs containing a given distress while #7 is and individual count/event and #8 is an average depth.

The PCC or rigid distress types coincide with the flexible fields and are entered into the same but appropriate data cell. This is done to simplify data entry and data import back into the CenterLine database.

1. Cracking
2. Joint and Crack Spalling
3. Pumping and Blowing
4. Faulting and Settlement
5. Patching
6. Raveling or Scaling
7. Blowups
8. Wear

## Miscellaneous Data

The rater's initials must be entered/selected from the pick list before any other operations are possible. Also, enter any comments you feel necessary. The comments should include any abnormal conditions you may encounter or any questions you may have. Always begin your comments with the year. For example, "2004 – Large Bad potholes". Please call your supervisor if you are uncomfortable with or unsure of anything you see. Also, be sure to check all street names and from/to information with the street signs and what you observe while in the field. Change any existing names or termini data that do not agree with what you see. You should indicate when you've made such changes in the comments field.

## Bridge Data

Bridges may be included in the database segmentation as separate segments and will generally be flagged or exempt, so as not to be included in the pavement analysis. If a bridge is encountered that is not in the database it should be added as a new segment and appropriately documented as a bridge. The length, width, surface type and surface condition should be recorded. If the bridge surface has been paved with the roadway surface, you should always rate it with the rest of the segment (or separately if it is a separate segment). The way bridges are handled will very from one agency to the next. Be sure to check with your supervisor as to how you should handle bridges for each separate agency.

## Line Color Control

The line colors are controlled by the field CLASS_2 fiels (which is displayed in the "Rated" text box on Tab D4) in the data table associated with the data entry form. Initially this column is identical to the CLASS column. However, when a record is saved this field is set to 44. If you want to turn a segment, so it doesn't show as being rated (red), change this number back to its original value (See "Rated" on Tab D4). Actually there are up to 10 different CLASS_2 values 1, 2 –to- 10, each of which can be set to a different color. At present these colors are set prior to shipping the program and by default 1, 2 & 3 are set to dark blue with varying line widths, 4 is set to black and 5 is green, see figure 13. You could use any scheme you wish for setting these CLASS_2 data. Also, if you wish to preset segments that have already been rated or you do not want rated, set the appropriate segment CLASS_2 field values to 44.

When a record is saved, while entering data on the Handheld PC, the CLASS_2 field is automatically set to 44. This changes the color of this line to red.

## File Structure and Field Relationships

Appendix B, in the Inventory module, provides the field layout/structure for all the different PDA modules, if you do not include a given column or field name in your database the application will work as designed, however, you will not be able to add data to the field/s you have left out. These applications were designed to meet the needs of many different users. Thus, there are fields you will not use for any given data collection operation.

## General iPaq Control

See your iPaq literature or appropriate third party documentation for further instructions on the operation of the iPaq and the Windows CE software, as well as for the ArcPad Software.

# Street Segment Application Forms

## Pavement Distress and Segment Inventory Data Collection

The following forms represent the Streets data collection module. The first figure shows the map that is shown on your Pocket PC along with the data entry form. This figure was actually generated from the desktop PC version of the ESRI ArcPad 6.0 software. On the Pocket PC you would only see a portion of this map and the form fills the full screen when opened as shown in Figure 4. In the maps in Figures 3,4 &5, the blue lines are the arterial/collector streets, the black lines are the residential/local access streets and the red lines represent the streets that have been rated. Both the arterial and residential streets are turned red when rated. The user can specify the colors associated with up to 10 different functional classification numbers, 1, 2 to 10. A duplicate column of the "CLASS" column must be included in the data table. It is called "CLASS_2". The system uses this column to control the line color. This field is set to 44 when the segment has been edited and saved. You can manually change the color of the line for this segment by changing this field.

You can double tap on the individual lines to bring up the forms or you can select the line and then press the forms button on the edit menu line, see Figure 4. Each of the tabs on the top of the data entry screen are selected by tapping on the tab itself, you can scan through or access the tabs not seen by taping on the left/right buttons at the extreme top right of the screen or use the "GoTo" D1/I1 button on the bottom of each tab. As seen in Figure 8, you press the "OK" button to save your entered data or press the "Cancel" button to exit without saving. You can not change tabs or enter/edit data without entering (or selecting) data into the "Obser" (Observer) box.

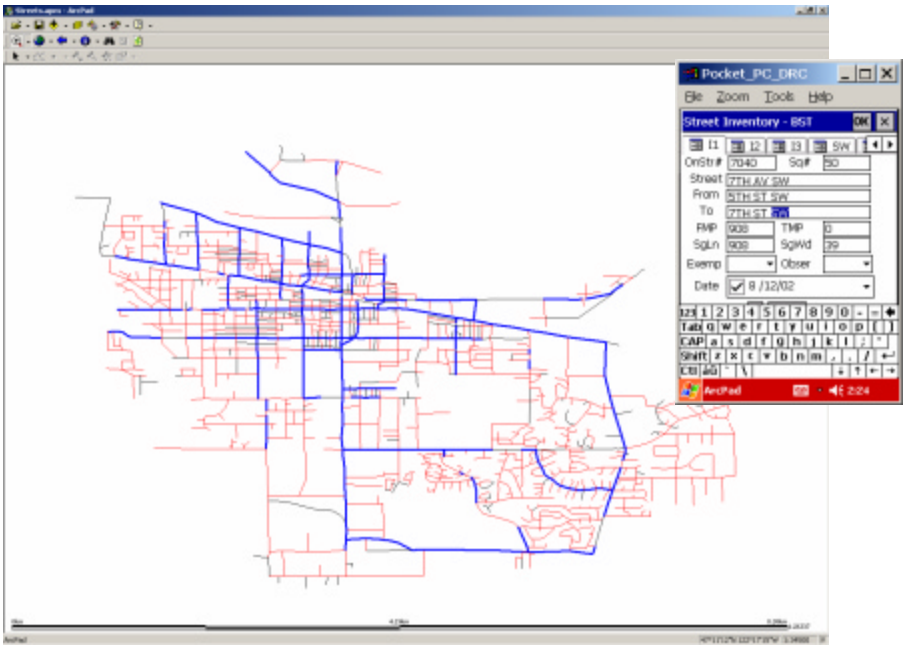



Figure 4 ArcPAD development screen and data entry form

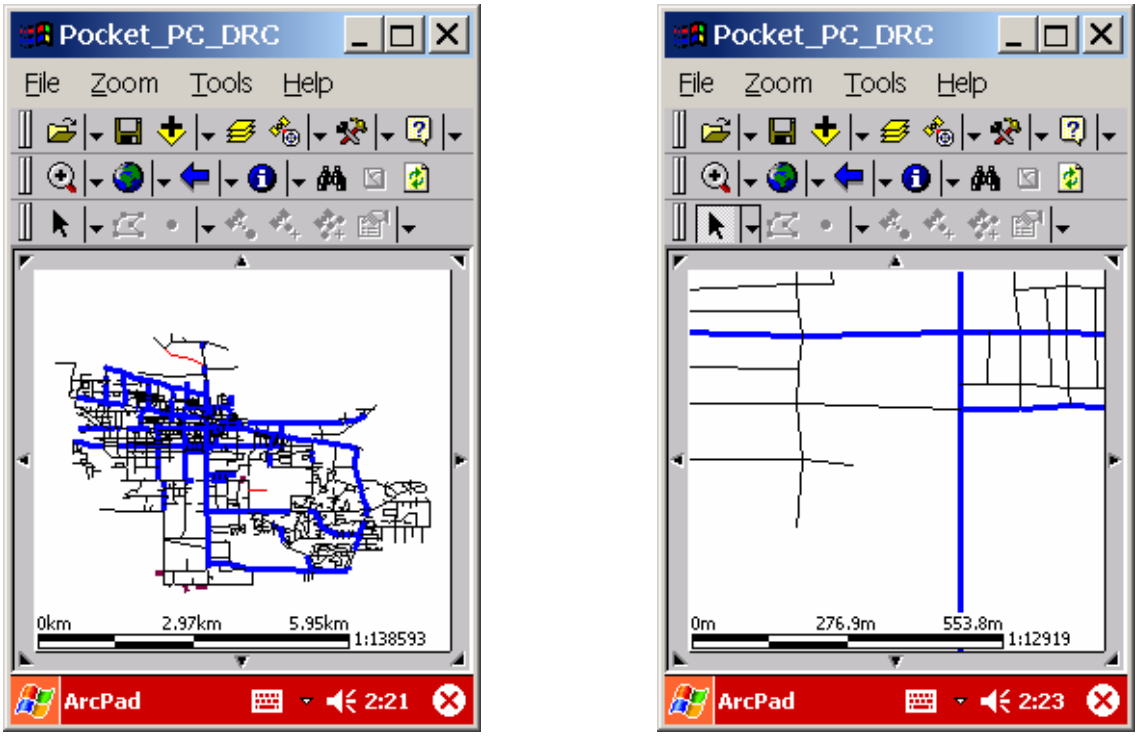



Figure 5 Screen prints from the Pocket PC showing two zoom levels

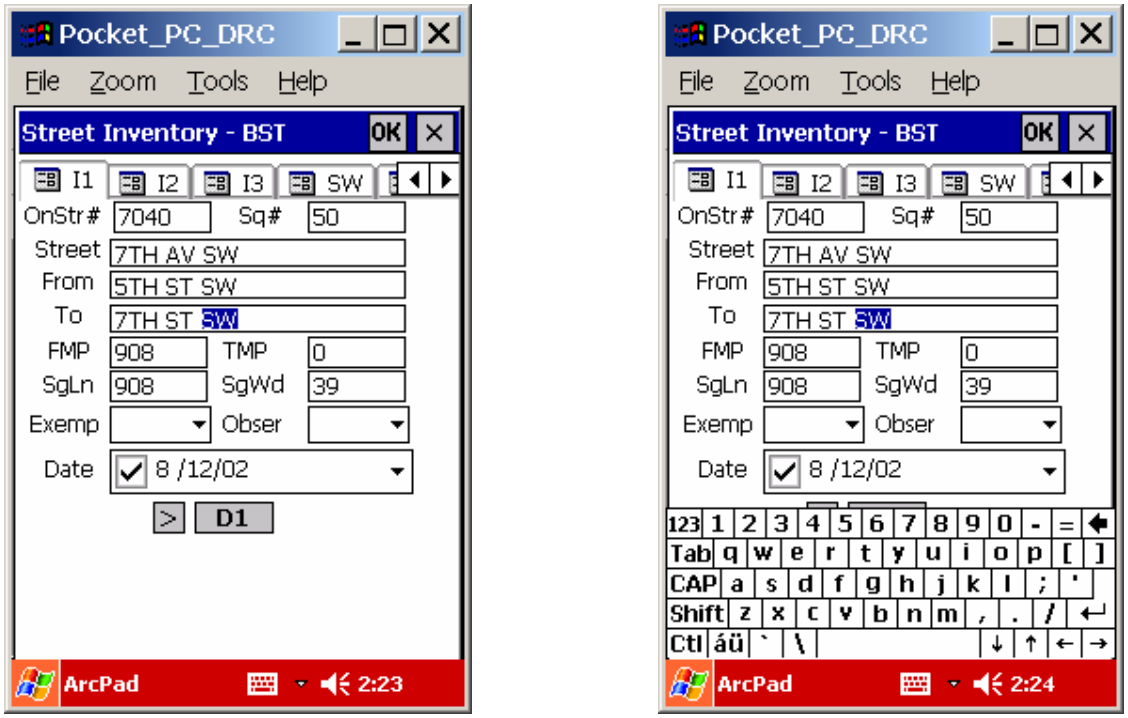



Figure 6 Screen prints showing the data entry form with & without keyboard for Tab I1

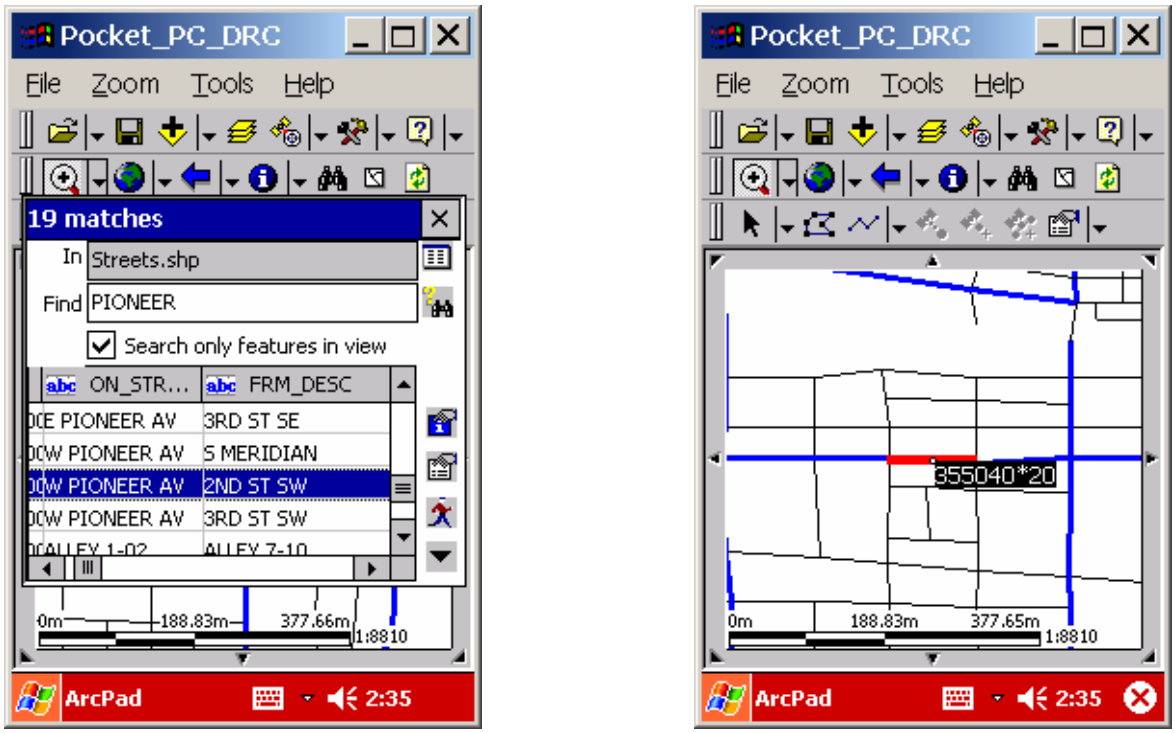



Figure 7 Screen prints showing the built in query tools from the ArcPad software

## Pocket PC Forms

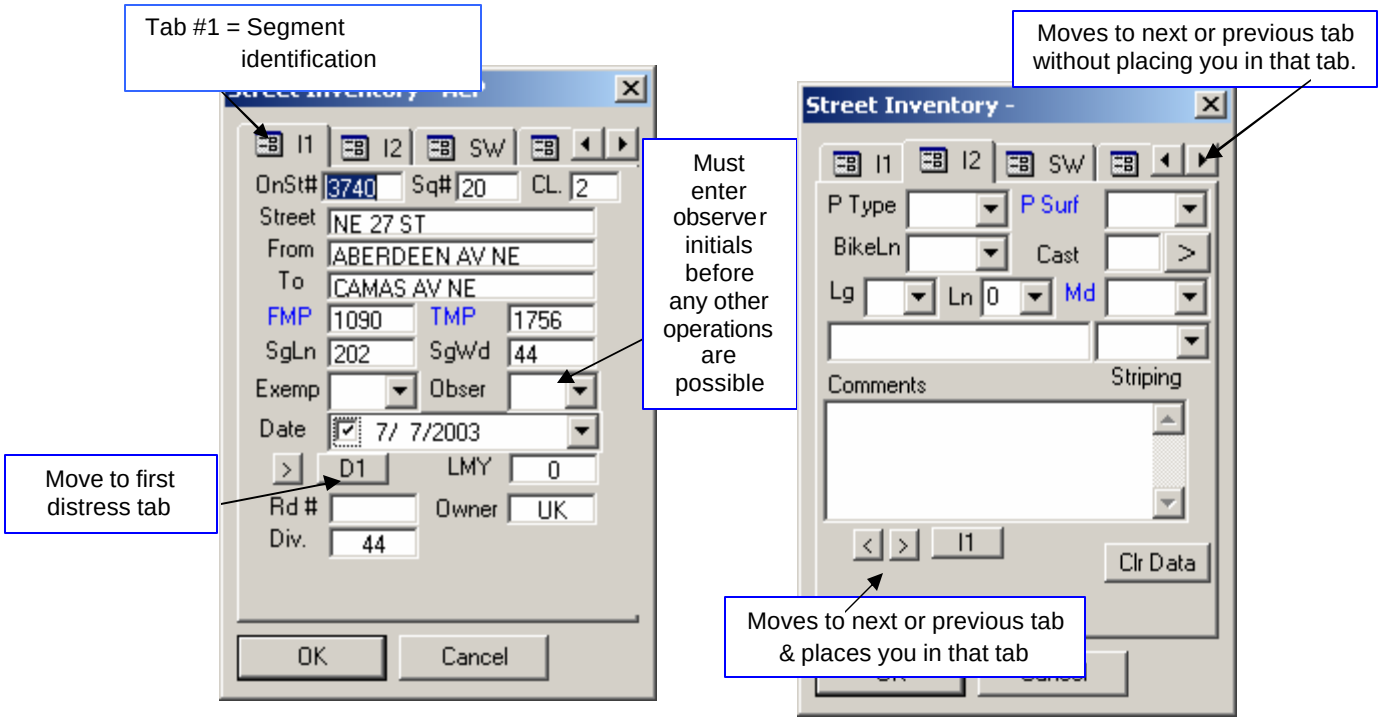



Figure 8 I1 tab = Identification tab #1 – I2= Identification tab #2

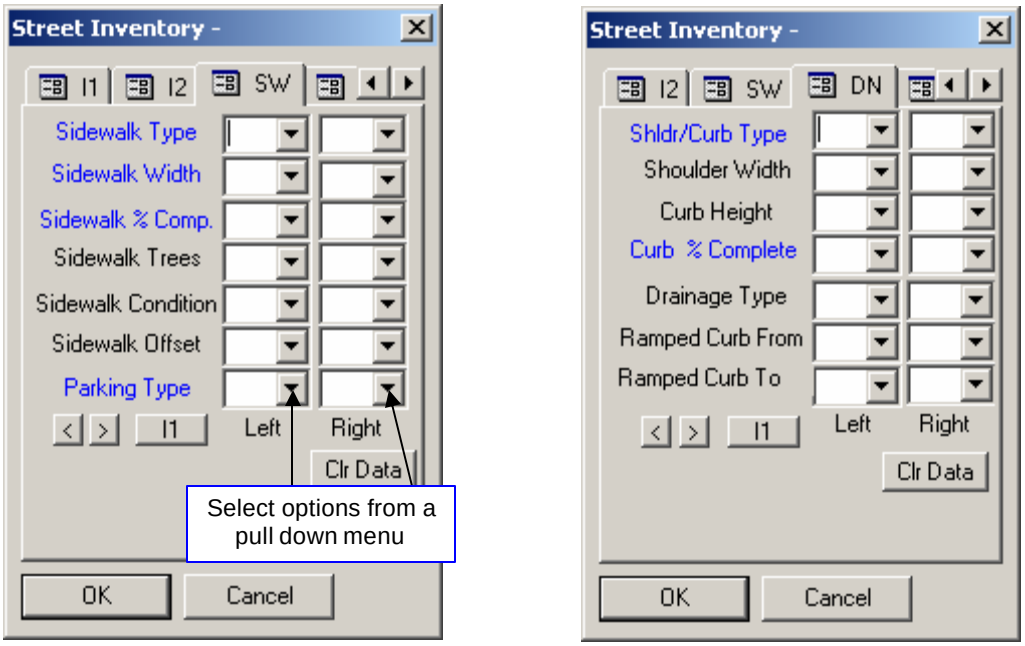



Figure 9 SW-Tab #3 - Sidewalks & DN-Tab #4 -Drainage & Curb Ramps

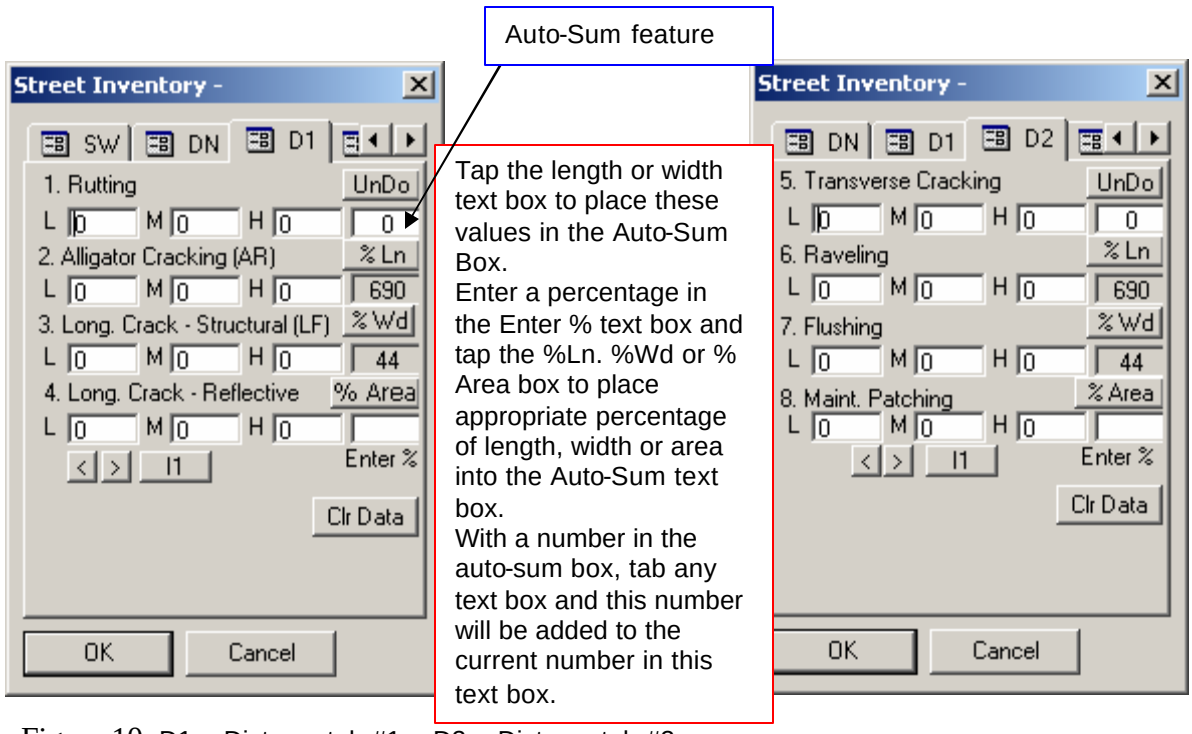



Figure 10 D1 = Distress tab #1 - D2 = Distress tab #2

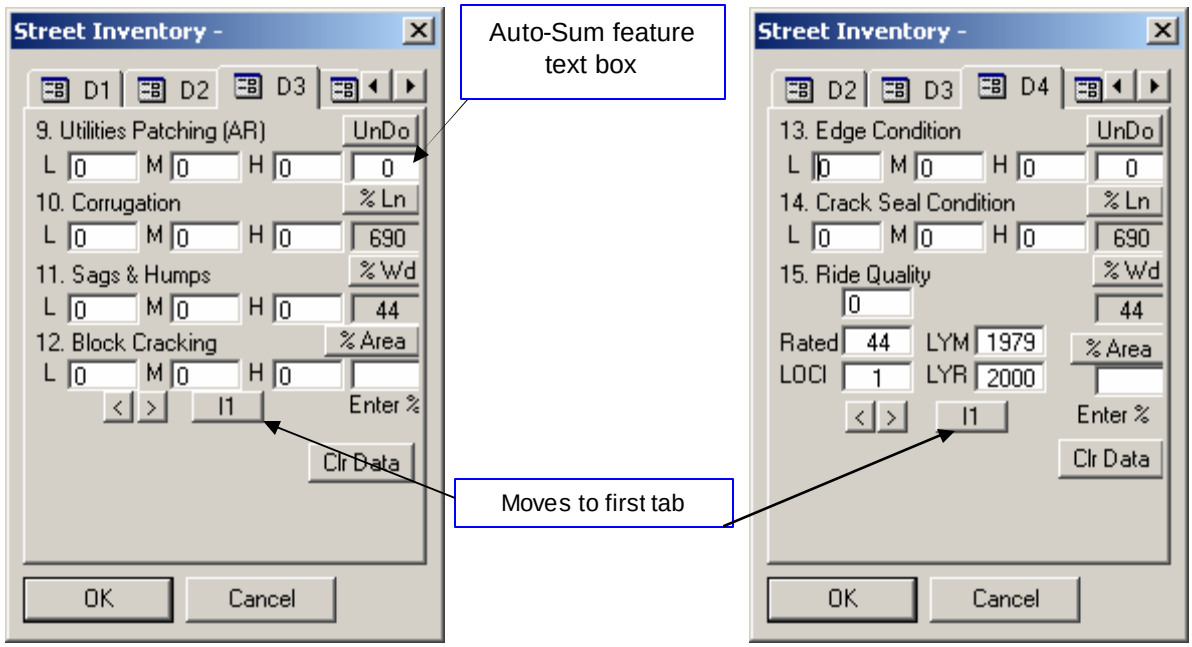



Figure 11 D3 = Distress tab #3 - D4 = Distress tab #4

The following figures show the PCC Forms. The system will automatically switch to these forms when a segment is selected which has a PCC/rigid pavement type. If you change the p-type on tab I1 and exit the form and reopen it you will see the proper distress rating tabs.

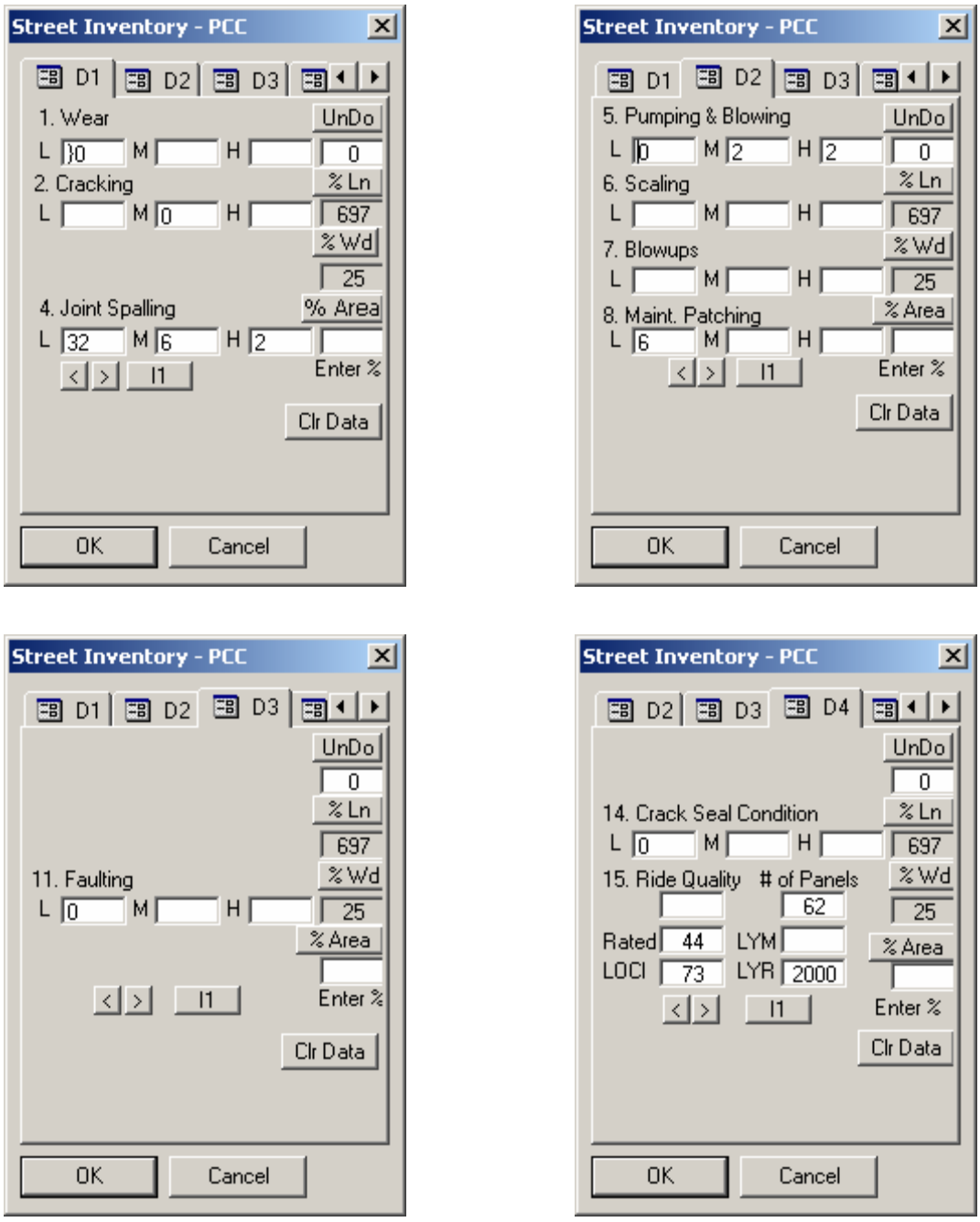



Figure 12 Rigid pavement distress tabs

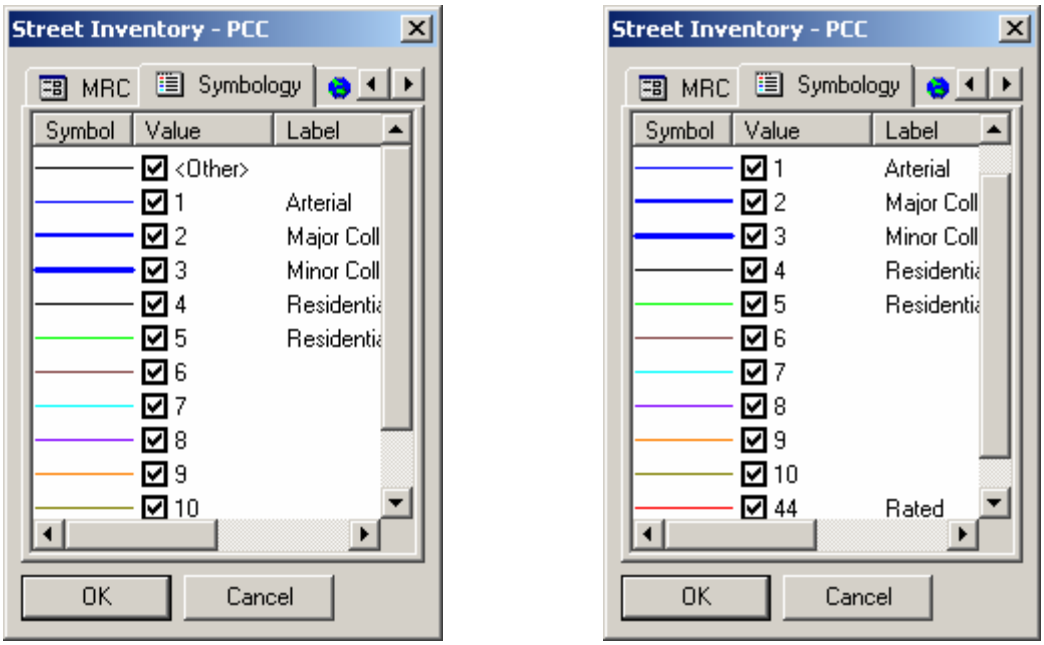



Figure 13 Map line color codes based on Functional Classification Numbers

Each map centerline has a color and/or width assigned to it based on the Functional Classification of that road/street. Once a street has been rated it is changed to red no matter what the original color may be. The color of each line is defined by the field "Rated" on the D4 tab. The 44 in this field defines "Red". If you change this field on the iPaq or via the original database (dbf file associated with ESRI shape file) it will be the color and line width shown in Figure 12.

## AutoSum Feature

The auto-sum feature allows the user to enter a number in the upper right corner of the screen and then by just taping the stylus on a data cell (edit box) the number is added to the current number in that cell. Pressing the "UnDo" button will put the original number back in the cell you just added the number to.

You can also tap the length or width text box to place these values in the Auto-Sum Box. Enter a percentage in the Enter % text box (ie 50 would be 50%, you can also use number greater than 100%) and tap the %Ln. %Wd or Enter % to place the appropriate percentage of the length, width or area into the Auto-Sum text box.

## Data Table Structure or Data Dictionary

See Appendix B in the CenterLine Inventory Manual in the CenterLine Inventory Manual for a table showing the input dBase table column names required to make the above forms work. This table is automatically generated from the CenterLine database report module. Once created from within CenterLine it must be converted to a dBase table and joined to your centerline base map data table using ArcView/Map and the resulting shape file must be copied to your Pocket PC and save as document file. See the detailed instructions in Appendix A of your Inventory Manual

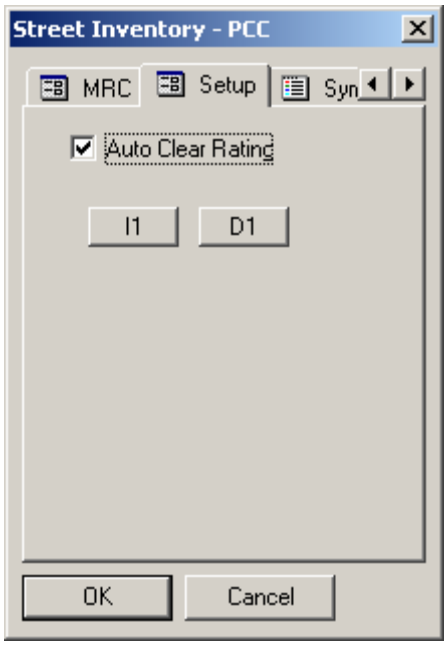



Figure 14 Setup screen for the clear data buttons

If the “Auto Clear Rating” check box is checked the “Clr Data” button on the various tabs is activated. If activated, when pressing this button all data on that form (tab) will be cleared.

# Appendix C

# Pavement Distress Field Reference Guide Short Form Sheets

# Notes to the Raters

This manual is written to address a general audience and as an educational tool to help an agency or individual understand what pavement rating options are available and for planning your rating operations. It also provides a training tool and users guide for rating your pavements. The following is an attempt to address the specific issues related to how MRC trains their raters, which are not defined specifically in this manual.

1. Each segment has two identification numbers which are used to identify and order the segments. The first is the "On Street Number" or road number and the second is a sequence number that identifies and orders the segments which make up this street name. The rater should always observe these numbers and note in the comments if they are out of order. Generally they will proceed from west-to-east and south-to-north or they will follow the address numbers. You should not edit or add these numbr in the field unless instructed otherwise.
2. When adding new streets you can leave the On# and Sq# number blank if you wish.
3. Always check the spelling and full proper name of each street as posted and make any needed edits. Use the same syntax as is currently in the database. Ex "Av" or "Ave" etc.
4. All segment lengths and widths should be look at and only edited if instructed to or if they are obviously wrong. Widths are measured to the pavement edge in all cases, include all pavement that would be paved during an overlay. Lengths are measured from the center of intersection and to the end of pavement if the street terminates at either end.
5. In general segments should not exceed about 1500 feet for the arterial & collector streets and about 2500 feet for the local access or residential streets/roads.
6. Always use the severity and extent definitions given in this appendix.
7. Enter/check/edit all segment and roadside inventory data. Some of this data may vary from one agency to another. Be sure to check with your supervisor prior to beginning each new agency.
8. Make as much use of the comments field as you can and always begin your comments with the year. i.e. 2003-new pavement. You can remove any existing comments if you wish.
9. There is a field on the first tab called "Exempt". <u>If this field is set to "Y" you do not rate or inventory this segment</u>. This segment does belong to the agency or it is not their responsibility to maintain. If you feel this field is set wrong please make a note in the comments field.
10. If you encounter streets which are not on the map or are incorrect, edit this on your handheld PC. When adding new streets you will be presented with a blank form. Add your data to this form and save it. If you do not save it, the data and the line you drew will disappear when you close the form. To remove a line you've drawn incorrectly or during practice, highlight it with your pen and press the delete key. You can us any of the first three drawing tools in your ArcPad software to draw lines.
11. Be sure to rate one or two segemnts that other raters have done each day.
12. Be sure the date and time is set properly on your pocket PC.
13. One member of each team should call MRC's office each day.
14. Make liberal comments on the hardcopy map/s and on your pocket PC.
15. Do not rate Exempt streets!
16. Measure all streets that termite or end to the actual end of the street or to the end of the cul-de-sac.

# WSEXT – Walking Pavement Distress Rating System (Flexible)

## Severity and Extent Summary for Manual Walking Surveys

The following is a summary of each pavement distress type and its quantification in terms of severity (how bad the distress is) and extent (over what area/length does it exist).

## Flexible Pavement Distresses

### 1. Rutting and Wear

Severity: Average Rut Depth over the segment.
Extent: Assume full segment length.
Data Entry: Single entry in 0.25 inch increments to right of description or in low severity on the handheld PC.
Comments: Estimate mean rut depth in inches. Use sags and humps for localized rutting.

### 2. Fatigue (Alligator) Cracking

Severity: (Crack size and Pattern)

| | |
|---|---|
| Low | Branching inner connecting longitudinal cracks. |
| Medium | Fully developed alligator pattern with some spalling |
| High | Severe spalling and pumping |

Extent: Entry the area of each severity in sq. units.

### 3. Longitudinal Cracking - Fatigue (Structurally) Related

| | | | |
|---|---|---|---|
| Severity: | Low | Less than | ¼ inch crack wide |
| | Medium | Greater than | ¼ inch crack wide. |
| | High | Greater than | ¼ in. Spalled cracks. |

Extent: Enter the length in feet – enter separately for each severity
Comments: Fatigue caused longitudinal cracks are the early or first stage of distress #2. These cracks have a distinct broken pattern and occur in the wheel path.

### 4. Longitudinal Cracking - Non-Structural - Joint Reflective and Construction Joint

Severity Same as #3
Extent Same as #3
Comments: This distress tends to be straighter and has more distinct cracks than longitudinal fatgue/alligator cracks

### 5. Transverse Cracking

Severity Same as #3
Extent Same as #3
Comments: Include localized alligator cracking in the transverse direction as high transverse cracks.

### 6. Raveling

| | | |
|---|---|---|
| Severity: | Low | Binder &/or aggregate has started to wear away. |
| | Medium. | Binder &/or aggregate has worn away and is rough. |
| | High | Surface texture is deeply pitted. |
| Extent: | Localized | = 1 – Isolated patches of raveling. |
| | Wheel paths | = 2 – Both wheel paths are fully raveled. |
| | Entire lane | = 3 – Complete surface is raveled. |

Data Entry: Enter predominate extent & severity to right of description – ex 2M=wheel path medium severity.

### 7. Flushing or Bleeding

| | | |
|---|---|---|
| Severity: | Low | Minor amount of aggregate is covered |
| | Medium | Significant amount of aggregate is covered |
| | High | Most of the aggregate is covered |

Extent: Same as $6

### 8. Patching – Maintenance -

Severity: Low Good condition.
Medium Moderately deteriorated – ride medium.
High Badly deteriorated – ride poor.

Extent: Entry the area in square feet for each severity.

Comments: Utility patching is rated separately.

### 9. Patching – Utility: Rated the same as #8, maintenance patching:

### 10. Corrugations and Waves

Severity: Low 1/8 in. to 2 in. change per 10 feet.
Medium 2 in. to 4 in. change per 10 feet.
High Over 4 in. change per 10 feet.

Extent: Enter the area in square units for each severity.

### 11. Sags and Humps - Same as #10

### 12. Block Cracking

Severity: Low 5x5 foot and larger blocks.
Medium 5x5 to 9x9 foot blocks.
High Greatet then 9x9 foot blocks.

Extent: Enter the area in sq. feet for each severity.

### 13. Edge Condition

Severity: Low = Edge Patching
Medium = Edge Raveling
High = Lane less than 10 feet
Extent: Enter the accumulated lengths for each severity.

Comment: Rate both sides of the street.

### 14. Crack Seal Condition

Severity: Low Crack sealant is in good condition.
Medium Crack sealant is open and allows water into crack.
High Crack sealant is missing or non-existent.

Extent: Percent of total cracks that are sealed. Enter percentage for each severity.

Comments: Example: 50L, 25M = 50% are sealed & in low condition plus 25% in medium condition. 25% are not sealed.

### 15. Ride Quality

This is generally not collected with a walking survey, however, if desired assign a number from one to ten with one being a perfect ride and 10 being the worst. If automated equipment is used, enter the mean IRI (International Roughness Index) value. You may also want to record the maximum, minimum and standard deviation values.

### 16. Drainage Index

This is generally not collected, however, if desired assign a number from one to ten with one being a good drainage score and 10 being the worst.

Note: When using paper forms - Distresses 1, 6, 7, 14, 15 and 16 are entered on the center portion of the form to the right of the distress name itself. All of the other distresses are entered into the lower portion of the form by placing the number associated with the distress being measured at the top of the column and accumulating the various amounts of the distress in the cells below. The final amount (extent) of each distress is then totaled at the bottom of the form. There is also a place at the bottom of the form for the previous years rating data, which is included if available.

When using handheld PC's all data is entered directly into the unit.

# WSEXT – Walking Pavement Distress Rating System (Rigid)

## Severity and Extent Summary for Manual Walking Surveys

The following is a summary of each pavement distress type and its quantification in terms of severity (how bad the distress is) and extent (over what area/length does it exist). In distresses 1 through 6 extent is defined as the number of slabs containing a given distress while enter the average depth into the low severity box..

## Rigid Pavement Distresses

### 1. Cracking

| | | |
|---|---|---|
| Severity: | Low | 1 crack per panel |
| | Medium | 3 cracks per panel |
| | High | 4 or more cracks per panel |

Extent: Enter the number of slabs for each severity (Same for distresses 1 through 6

### 2. Joint and Crack Spalling

| | | |
|---|---|---|
| Severity: | Low | 1/8-in. to 1-in. spalls |
| | Medium | 1-in. to 3-in. spalls |
| | High | Greater than 3-in. spalls |

### 3. Pumping and Blowing

| | | |
|---|---|---|
| Severity: | Low | Slight shoulder depression, no staining |
| | Medium | Significant depression, slight staining |
| | High | Severe depression, significant staining |

### 4. Faulting and Settlement

| | | |
|---|---|---|
| Severity: | Low | 1/8-in. to ¼-in. faulting or settlement at joints or cracks. |
| | Medium | ¼-in. to ½-in. faulting or settlement at joints or cracks. |
| | High | Over ½-in. faulting or settlement at joints or cracks. |

### 5. Patching

| | | |
|---|---|---|
| Severity: | Low | Good condition. |
| | Medium | Moderately deteriorated – ride medium. |
| | High | Badly deteriorated – ride poor. |

### 6. Raveling or Scaling

| | | |
|---|---|---|
| Severity: | Slight | Aggregate and binder has started to wear away. |
| | Moderate | Aggregate and/or binder has worn away & surface texture is moderately rough |
| | Severe | Aggregate and/or binder have worn away significantly. |

### 7. Blowups

| | |
|---|---|
| Severity: | Not defined |
| Extent: | Number of occurrences per segment |

### 8. Wear

| | |
|---|---|
| Severity: | Enter mean depth to nearest ¼” |
| Extent: | The extent of wear is assumed to be the full length of the segment. |

# WSPCR$_2$ – Local Agency Windshield Distress Ratings (Flexible)

## Severity and Extent Summary for Manual Windshield Surveys

The following is a summary of each pavement distress type and its quantification in terms of severity (how bad the distress is) and extent (over what area/length does it exist). The extent ranges given below are intended for use in a moving windshield survey. Entry a 1, 2 or 3 into the appropriate severity column on the form for each distress type observed. All severity levels are included in the predominate severity when estimating extent quantities. Rate only the outer lane in one direction is common.

## Flexible Pavement Distresses – Windshield

### 1. Rutting and Wear

Severity: The average rut depth in the wheel path for the segment or sample.

| | | |
|---|---|---|
| 1 | = Low | ¼ in. to ½ in. |
| 2 | = Medium | ½ in. to ¾ in. |
| 3 | = High | over ¾ in. |

Extent: Assumed to be the full length/area of the surveyed segment. Enter into low seveity box when using your handheld PC.

### 2. Fatigue (Alligator) Cracking

Severity:

| | |
|---|---|
| 1 = Low | Longitudinal cracks. |
| 2 = Medium | Fully developed alligator pattern with some spalling |
| 3 = High | Severe spalling and pumping |

Extent: Percentage of the length of both wheel paths.

| | | |
|---|---|---|
| 1 | = 1% - 9% | of both wheel paths or by area |
| 2 | = 10%-24% | of both wheel paths or by area |
| 3 | = 25%- 50% | of both wheel paths or by area |
| 4 | = 50%-or more | of both wheel paths or by area |

### 3. Longitudinal Fatigue Cracking

Severity:

| | |
|---|---|
| 1 = Low | Less than ¼ inch |
| 2 = Medium | Greater than ¼ inch with Spalling |
| 3 = High | Greater than ¼ inch with Spalling and Pumping |

Extent: Percentage of the length of the surveyed segment or by length

| | | |
|---|---|---|
| 1 | = 1% -99% | of the length of the segment or by length |
| 2 | = 100% - 199% | of the length of the segment or by length |
| 3 | = 200% or more | of the length of the segment or by length |

### 4. Longitudinal Reflective Cracks

Severity: Same as #3

Extent: Same as #3

### 5. Tansverse Cracking

Severity: Same as #3

Extent: Frequency, counts per 100 feet.

| | | |
|---|---|---|
| 1 | = 1-4 | cracks per 100 ft. or by length |
| 2 | = 5-9 | cracks per 100 ft. or by length |
| 3 | = 10 or more | cracks per 100 ft. or by length |

### 6. Raveling and

### 7. Flushing

Severity:

| | |
|---|---|
| 1 = Low | Slight |
| 2 = Medium | Moderate |
| 3 = High | Severe |

Extent:

| | |
|---|---|
| 1 | = Localized |
| 2 | = Wheel Paths |
| 3 | = Entire Lane |

## 8. Patching – Maintenance

## 9. Patching – Utility

Severity: 1 = Low Good condition.
2 = Medium Moderately deteriorated – ride medium.
3 = High Badly deteriorated – ride poor.

Extent: Percentage of length of both wheel paths.
1 = 1% - 9% of both wheel paths or by area
2 = 10% - 24% of both wheel paths or by area
3 = 25% or more of both wheel paths or by area

Comments: Utility patching is rated separately

## 10. Corrugation and Waves

Severity: The maximum deviation from a 10-foot straight edge
1 = Low 1/8-in. to 2-in. change per 10 ft.
2 = Medium 2-in. to 4-in. change per 10 ft.
3 = High Over 4-in. change per 10 ft.

Extent: Same as #9

## 11. Sags and Humps

Severity: Same as #10

Extent: Same as #9

## 12. Block Cracking

Severity: Block Size
1 = Low 9x9 and larger blocks
2 = Medium 5x5 to 9x9 blocks
3 = High 2x2 to 5x5 blocks

Extent: Assumed to be the full length of the segment.

## 13. Pavement Edge Condition

Severty: 1 = Low Edge patching extent (severity is undefined)
2 = Medium Edge raveling extent (severity is undefined)
3 = High Edge lane less than 10 feet extent (severity is undefined)

Extent: Percent of twice the segment length.

## 14. Crack Seal Condition

Severity: 1 = Low Hairline cracks in the sealant allow only minimal water passage.
2 = Medium The crack sealant is open and will allow significant water passage.
3 = High The crack sealant is very open or non-existent.

Extent: Same percentages as #9 but based on the total length of all cracks &/or joints.

# Severity and Extent Summary for Manual Windshield Surveys (Rigid)

The following is a summary of each pavement distress type and its quantification in terms of severity (how bad the distress is) and extent (over what area/length does it exist). The extent ranges given below are intended for use in a moving windshield survey. Entry a 1, 2 or 3 into the appropriate severity column on the form for each distress type observed. All severity levels are included in the predominate severity when estimating extent quantities. Rate only the outer lane in one direction.

## Rigid Pavement Distresses – Windshield

### 1. Cracking

Severity: Low 1 crack per lane panel.
Medium 2 or 3 cracks per panel.
High 4 or more cracks per panel.

Extent: 1 = 1% to 9% of the slabs are cracked.
2 = 10% to 24% of the slabs are cracked.
3 = 25% or more or the slabs are cracked.

### 2. Joint and Crack Spalling

Severity: Low 1/8-in. to 1-in. spalls.
Medium 1-in. to 3-in. spalls.
High Greater than 3-in. spalls.

Extent: Same as #1.

### 3. Pumping and Blowing

Severity: Low Slight shoulder/lane depression, no staining.
Medium Significant depression, slight staining.
High Severe depression, significant staining.

Extent: Same as #1.

### 4. Faulting and Settlement

Severity: Low 1/8-in. to ¼-in. faulting or settlement at joints or cracks.
Medium ¼-in. to ½-in. faulting or settlement at joints or cracks.
High Over ½-in. faulting or settlement at joints or cracks.

Extent: Same as #1.

### 5. 5. Patching

Severity: Low Patch is in good condition.
Medium Patch show low to medium distress and ride quality.
High Patch shows severe distress and poor ride quality.

Extent: Same as #1.

### 6. 6. Raveling or Scaling

Severity: Low Aggregate or binder has started to wear.
Medium Aggregate and/or binder has worn away & the surface texture is moderately rough.
High Aggregate and/or binder have worn away significantly.

Extent: Same as #1.

### 7. Blowups:

Severity: Not defined.
Extent: Number of occurrences per segment.

### 8. Wear

Low ¼ to ½ inch.
Medium ½ to ¾ inch.
High over ¾ inch.

Extent: The extent or wear is assumed to be the full length of the segment

# Appendix D

# Field Rating Forms

## Flexible Pavement Inspection Form  Sheet Sq# _____

Date:  PAVEMENT/SEGMENT DATA  Left  Right

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Str/Sq#: | | | Sg Length: | | | Sidewalk Type: | | |
| Str. Name: | | | Sg Width: | | | Sidewalk Width: | | |
| From Desc: | | | Shldr/curb Type | | | Sidewalk Cond. | | |
| To Desc: | | | Shldr. Width: | | | Sidewalk %Comp | | |
| Bus Routes: | | Speed | Min. Curb Ht. | | | Ramped Curb/Fr | | |
| # Casting: | | Lanes | StormSys. | | | Ramped Curb/To | | |
| Pav. Type: | | Class | Parking: | | | Striping: | | |
| Observer: | | Exempt | Bike Lanes: | | | Lighting: | | |

**COMMENTS:** (Including bridge, median, lane width and excessive crown information etc.) _____

_____

_____

_____

| DISTRESS TYPES | | | | GRAPHIC |
|---|---|---|---|---|
| 1. Rutting & Wear | _____ | 9. Utility Patching | (AR) | |
| 2. Alligator/Fatigue Cracking | (AR) | 10. Corrugations & Wave | _____ | |
| 3. Long. Crack - Structural | (LF) | 11. Sags & Humps | _____ | |
| 4. Long. Crack - Reflective | (LF) | 12. Block Cracking | _____ | |
| 5. Transverse Crack | (LF) | 13a. Edge Raveling Ext. | _____ | |
| 6. Raveling | _____ | 13b Edge Patching Ext. | _____ | |
| 7. Flushing | _____ | 14. Crack Seal Condition | _____ | |
| 8. Maintenance Patching | (AR) | 15. Ride Quality | _____ | |

| . | DISTRESS TYPES | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 2 | 3 | 4 | 5 | 8 | 9 | 13 | |
| Direction | | | | | | | | |
| | | | | | | | | |
| Fwd | | | | | | | | |
| | | | | | | | | |
| Rev | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| **Total L** | | | | | | | | |
| **Severity M** | | | | | | | | |
| **Data H** | | | | | | | | |
| **Previous L** | | | | | | | | |
| **Rating M** | | | | | | | | |
| **Data H** | | | | | | | | |

## Rigid Pavement Inspection Form  Sheet Sq# _____

Date:  PAVEMENT/SEGMENT DATA  Left  Right

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Str/Sq#: | | | Sg Length: | | | Sidewalk Type: | | |
| Str. Name: | | | Sg Width: | | | Sidewalk Width: | | |
| From Desc: | | | Shldr/curb Type | | | Sidewalk Cond. | | |
| To Desc: | | | Shldr. Width: | | | Sidewalk %Comp | | |
| Bus Routes: | | Speed | Min. Curb Ht. | | | Ramped Curb/Fr | | |
| # Casting: | | Lanes | StormSys. | | | Ramped Curb/To | | |
| Pav. Type: | | Class | Parking: | | | Striping: | | |
| Observer: | | Exempt | Bike Lanes: | | | Lighting: | | |

**COMMENTS:** (Including bridge, median, lane width and excessive crown information etc. here) _____

_____

_____

_____

| DISTRESS TYPES | | GRAPHIC |
|---|---|---|
| 1. Cracking # of panels | 5. Patching # panels | |
| 2. Joint/Crack Spalling # panels | 6. Raveling or Scaling # panels | |
| 3. Pumping & Blowing # panels | 7. Blowups (enter # of Ocur)_____ | |
| 4. Faulting/Settlement # panels | 8. Wear: (enter avg depth) _____ | |

| | DISTRESS TYPES – Enter # of Panels | | | | | | |
|---|---|---|---|---|---|---|---|
| Fwd | 1. Cracking | 2. Spalling | 3. Pumping | 4. Faulting | 5. Patching | 6. Raveling | # of panels in segment: |
| Rev | 1/panel | 1/8' - 1" | slight depr | 1/8" - 1/4" | Good | | |
| | | | | | | | |
| | | | | | | | |
| Low | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | (2 or 3)/pl | 1" - 3" | mod dp,slst | 1/4" - 1/2" | Fair | | |
| | | | | | | | |
| | | | | | | | |
| Medium | | | | | | | |
| | | | | | | | |
| | > 3/pl | > 3" | sev. depr/st | > 1/2 " | Poor | | |
| | | | | | | | |
| High | | | | | | | |
| | | | | | | | |
| **Total L** | | | | | | | |
| **Severity M** | | | | | | ____blowups | _____panels |
| **Data H** | | | | | | | |
| **Previous L** | | | | | | | |
| **Rating M** | | | | | | | |
| **Data H** | | | | | | | |

# Appendix E

## Changes Specific to Pierce County Project

# Appendix E
## Addendum to MRC's Raters Guide
### Pierce County Data Collection

Rating Manual Differences between MRC and Pierce County – Anything not listed will be done as stated in MRC's Rating Manual.

1. *Alligator Cracking – Enter temporary pothole (cold mix – *Add photo's*) patching & temporary edge patching (Add *photo's and define in detail*) into high severity Alligator Cracking. MRC currently puts all all pot hole patching into high severity alligator patching.
2. *Patching – Only chip seal/Skin Patching is rated and recorded. All other patching is ignored, however, all distresses within or around all patches, including skin patches, are rated separately as is documented in MRC's rater's manual.
3. Rate sealed cracks that are in good condition around patches as low severity cracks. MRC ignors these.
4. BST raveling is rated as flushing.
5. *Edge Condition – Only edge raveling is to be rated & placed in low severity – Ignore permanent edge patch, but rate any distress in the patch
6. Block Cracking is not rated.

**General Notes**

Verify the segment definition data provided; for example, segment limits, all street names, pavement surface type, width, and length. Also, make or comment on any obvious changes in functional classification. Only change lengths and widths if they are obviously wrong. Also, make notes in the comments as to these types of changes. Only edit surface type and not the pavement types. Only edit and/or check items that are in blue text on the Pocket PC.

**How and When to Break Segments**

The raters will make any segmentation changes which include new segment breaks or adding new segments, by drawing new lines on the map using the handheld PC. A parallel line next to an existing line on the map showing the approximate new segment break is to be use for modifying existing segmentation. Put the new rating data for the first segment in the existing segment record and place the data for the new section into the newly drawn segment.

For new segments, draw new lines to represent these sections of pavement. When adding new lines, try to draw as close as possible to what you see in the field. However, you are not expected to get these new segments/map lines that exact, just be sure to add a new line and enter the required data for each segment of pavement being added to the map. Be sure to measure the length and width. When drawing new segments use center of intersection to enter of intersection for breaks.

If you see two or more segments that you feel should be merged together, note this in the comments but do not merge segments in the field.

**BREAK OR DIVIDE PMS SEGMENTS WHEN YOU SEE A CHANGE IN :**

- Route number
- Route name (Street name)
- Function classification
- Number of driving lanes
- Pavement width – see width measurement instructions
- Pavement type or rehabilitation surface type
- Surface type, such as BST over ACP, does not change the pavement type.
- If a full width patch is greater than 500 feet.
- Also see instructions below

**Pavement Width Guidelines**

Width as defined here equals the average width within a segment (minimum of two measurements must be taken per segment). Change existing width or split segments based on a changed condition as follows

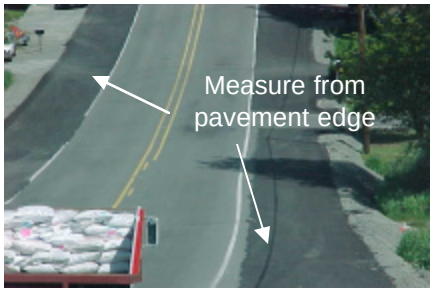
1. Change width only if average change/difference is greater than 2'.
2. Width change is treated, as a definite transverse break not a taper. Make break at mid-taper point.
3. ACP and BST pavements; measure from edge to edge
4. ACP driving lanes w/BST shoulders; measure driving lanes separate from shoulders
5. ACP and BST pavements w/ raised edge sections; measure from back of raised edge to back of raised

edge.

6. ACP and BST pavement w/concrete curb and gutter; measure from face of curb to face of curb.
7. ACP and BST pavement w/rolled concrete curb and gutter; measure from top of curb to top of curb.

Miscilaneous information:

1. Asphalt Shoulders: Shoulders with a longitudinal paving joint **inside** the painted edge stripe - measure the total width of the road. See Photo #2 below. Shoulders with a longitudinal paving joint **outside** the painted edge stripe; measure the width of the road from paving joint to paving joint excluding shoulders.
2. Cul-De-Sac Bulbs: Bulbs (**as a road of its own**) of 0.03 miles (150 feet) in length or less; use the diameter of the cul-de-sac as the pavement width. Bulbs greater than 0.03 mile in length use incoming throat width of the road as the pavement width. Bulbs as an extension of the existing road use the average width of the road preceding the extension as the width.
3. Road Bulbs: Bulbs of 0.03 miles in length or less - use width of road prior to bulb as the pavement width. Bulbs greater than 0.03 miles in length use diameter of bulb as the pavement width and define bulb as a separate segment in the Database.
4. Measure all lengths to the end of the bulb.








## Field Roadside Inventory Summary

The following inventory items are to be collect in addition to the verification and editing of all data on tab I1. These are the only inventory items that you will collect data for. The descriptive text for these items is blue on your iPAQ. These are the only items on tabs I2, SW & DN that you are to collect data for. However, be sure to verify all data on tab I1 and the "P Type", "Lanes" & "Class" on tab I2.

Collect Inventory data for the following, be sure to check or confirm all data on tabs I1 & I2 and remove all data on all other tabs and update with current information. Only edit fields with blue text on the "SW" (sidewalk) and "DN" (Drainage) tabs.

### 1. % CURB COMPLETED – Enter a number from 0% to 100% or each side of roadway

### 2. CURB & SHOULDER TYPE,

| | |
|---|---|
| N | None |
| VC | Vertical PCC curb |
| RCC | Rolled PCC curb w/ gutter |
| VCE | Vertical PCC extruded |
| RE | Raised or rolled ACP edge (wedge curb) |
| VAE | Vertical ACP extruded |
| VCG | Vertical PCC curb w/ gutter |
| AS | ACP shoulder |
| BS | BST shoulder |
| GV | Gravel shoulder |

### 2b. SHOULDER WIDTH

### 3. SIDEWALK WIDTH – Enter in feet to nearest foot

### 4. SIDEWALK % COMPLETED – Enter a number from 0% to 100% for each side

### 5. SIDEWALK & PATH TYPE

| | |
|---|---|
| N | None |
| SWC | Sidewalk PCC |
| SWA | Sidewalk ACP |
| SWB | Sidewalk BST |
| CP | PCC path |
| AP | ACP path |
| BP | BST path |
| GP | Gravel path |

### 6. PARKING TYPE

| | |
|---|---|
| N | None |
| ACP | Asphalt concrete |
| PCC | Portland cement concrete |
| BST | Bituminous surface treatment |
| GRV | |

### 7. MEDIAN TYPE

| | |
|---|---|
| N | None |
| AM | Center median - paved |
| PM | Center median - planted |
| GM | Center median - graveled |

### Functional Classification designations (Also see "Division field on tab I2 for CRIS definition number)

1. Urban - Principle arterial roads - 14
2. Urban - Minor arterials - 16
3. Urban – Collector arterials - 17
4. Urban – Local access - 19
5. Rural – Minor arterials - 6
6. Rural – Collector arterials - 7
7. Rural – Minor Collector - 8
8. Rural – Local access ? – 9
9. Private + ?

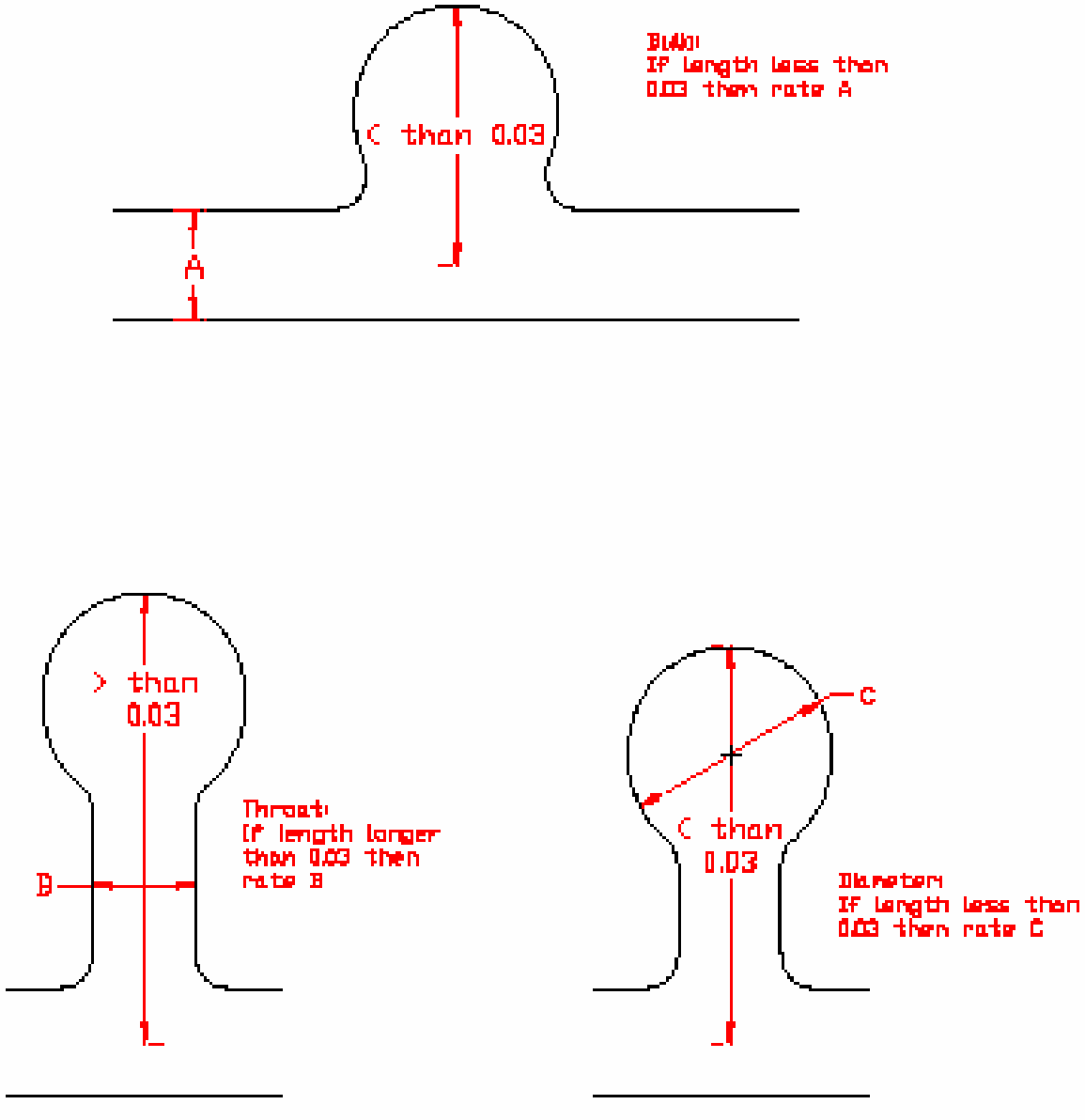
Misc.
Check/confirm gravel roads and exempt roads

### Suggestions to improve operation:

The following are some suggestions based on observations made in the 2003 data collection effort that could help to improve on the quality and quantity of data collected.

1. Edge conditions – Edge raveling is OK, Edge patching – rate as defined, Edge Lane >10' – use this for temporary edge patches.
2. Rate all patching – Maintenance and Utility – but place your skin patching into a specific field.
3. BST Raveling – collect as raveling and import as flushing.
4. Add more pictures and explanations – specifically relating to your patching types and edge conditions

# Rating Bulbs and Cul de Sacs



# Appendix F

# Raters Agreement of Understanding

# Raters Contract and Agreement

With

# Measurement Research Corporation

## Introduction

This contract is intended to provide a clear understanding between the individual employees involved in collecting field data and MRC. This would involve all field type work, including, pavement surface distress and roadway inventory data collection, pavement coring and deflection testing.

## Job Expectations

Each employee is expected to work a minimum of 40 hours a week if the weather permits. This can be any days of the week that best fit your schedule. The rater/s are expected to watch the weather carefully and if possible to schedule their work around the changes in the weather. This may mean that work will have to be done on the weekends, if that is when the weather is clear or traffic permits (heavy traffic may require week end rating). You will be required to wear a safety vest at all times while working in the field and possible a hard hat, depending on each agencies requirements. Also, you will exercise extreme care while working in the field as to safe operations. If you have any concerns related to safety or to normal operations, you are to call MRC and discuss them. MRC will provide whatever support is needed and will provide all necessary training on how to perform your regular duties in a safe and efficient manner.

All fieldwork and the logistics of how it is to be performed are in general left up to each individual or pair of employees unless requested or instructed otherwise. This includes the sequence in which segments are chosen for rating and how the workload is shared between rating team members. However, care must be taken to insure that the most efficient procedures are used and maintained. Regular monitoring and interaction with each employee will be maintained by MRC as to the quality and quantity of work performed. The average expectations for the quantity of work performed will vary with each individual and the pavement conditions associated with a given agency or section of an agency. However, in urban areas past raters have averaged about 5 to 6 centerline miles a day or about 30-to-40 rating forms for each rater in an 8 hour day. This can vary considerably with the severity of the distresses within the segments being rated and the traffic levels. If you feel that you are not able to perform at these levels please discuss this with MRC. At all times the safety and quality associated with the work being performed is far more important than the quantity.

Each rater will be trained as to how to rate the pavements and in collecting the inventory data. However, each rater is encouraged to develop his or her own work habits and procedures. Everyone has their own unique way of doing things. Just keep safety and the quality of the work being performed at the forefront of your methods of getting the job done in an efficient manner.

Any changes in the map/s provided to you should be noted and well documented on the map and/or field notes. Each rating team will be provided with a large format map/s of each agency being surveyed and with a detailed database listing. All raters will be required to highlight each street as it is rated on this map and in the database listing. Any changes in the map, database or forms must be clearly marked and attention to these changes may require personal contact or interaction with the data entry personnel. This should included:

1. New roads
2. Deletions that are on the map but not found in the field
3. Noting any pavement type or width changes if not clearly specified in the database
4. Street name changes or other data on the rating form and/or map.
5. Anything that you feel needs to be included or addressed.

## Travel

Each individual employee or pair or employees, when working in pairs, will be provided with an MRC vehicle. Flashing safety lights will also be provided for the vehicle you are using. The mileage will be based on your vehicle mileage while on the job only. MRC will not pay mileage for your commute to and from work for jobs, which are within a 30-mile radius of our office.

For all travel to and from the job site of less than a thirty-mile radius from MRC's office, the time spent commuting to and from the job site is not to be compensated for. This is considered normal commuting time. For any distance greater than 30 miles you will be compensated for the time spent commuting beyond the 30 mile radius. This will be in addition to vehicle mileage (if you are using your own vehicle) and will be based on mileage and not the actual time spent, to make it easier to manage. You will receive $0.35 per mile for all mileage over and above the miles required to reach the 30-mile radius from MRC's office. A fixed mileage will be agreed to for each agency/project based on the miles to the city or county center. The actual mileage to be considered or used for each job/agency will be agreed to prior to beginning each job.

If the job site is greater than 50 miles (50 mile radius) from MRC's office, you have the option of staying in a motel and will receive per diem to cover these expenses. MRC will provide a daily per diem of $65.00 per individual or $85.00 for a two person rating team. This is to cover your motel and partial food costs. A prearranged motel room can be provided by MRC if desired.

## Hourly Salary

Your hourly salary rate will be $_____. Bonuses can be expected at the end of the rating season (the fall of the year) if the employee has performed well and MRC has seen a reasonable profit. No preset amount will be assumed or provided.

## Pay Period & Time Sheets

Payday will be the 2nd and 4th Friday of each month. Raters will log the time when starting the ratings at the job site and the time when they first leave the job site. Any allowable compensation for travel time will be monitored separately as outlined elsewhere in this document. No travel time is to be included on your time sheets. Also, any time spent running personal business or for eating, breaks or any non-rating related functions. are to be included on the time sheet. That is, the time sheet is to only contain hours for actual time spent rating the streets and any work related to the ratings.

## Overtime Pay

Time and one half will be paid for all hours over 40 hours a week. MRC maintains the right to set the amount of overtime that can be included in any given week and for any given project (agency). No overtime will be paid for greater than 8 hours in a single day unless the minimum of 40 hours for that week has been reached. A week is considered to be Sunday through Saturday. No overtime is to be allowed without previous agreement with MRC or requested by MRC.

## Bad Weather

It is generally understood that if possible roadways should only be rated in dry weather. However, a strict adherence to this is not economically feasible to MRC and the final decision as to whether you can continue rating or as to whether to even go to work on any given day or time period within a given day must be decided through interaction with MRC unless or until you have establish other guidelines for making these decision. However, it is obvious that while in the field, and it starts to rain, that you should stop distress ratings and wait until it clears or stop for the day. If you don't have other work that you can do and feel the best thing is to stop for the day, please call MRC and let use know.
If you have questions as to whether you should go to work on any given day due to weather you should call MRC and we will advise you. However, you should always keep an eye on the weather predictions and try to use your own judgment whenever possible.

If you get caught in the field and get rained out, MRC will guarantee a minimum of 4 hours pay for that day if you've contacted MRC and they agreed or instructed you to work that day. If you have rain while working and feel that it will clear up you should wait till it clears up and continue working. Again use your own judgment and/or call MRC for advice. You should not rate during the time it is actually raining unless instructed to, however, you can rate wet pavements just be careful to account for the exaggerated crack conditions caused when the pavement is dry and the cracks are still wet. You should try to maintain work tasks, which can be done in the rain to make the best use of your time. The following is a list of items that can be done in the rain. Your supervisor may expand on this list for specific agencies or reasons.

1. Rating of PCC streets.
2. The verification of streets that have been constructed within the last three years (LMY)
3. Collecting of inventory data
4. Measuring of lengths, widths etc. if this is required for a given job
5. Any required digital pictures or video
6. Sorting of forms and planning for future rating work
7. Updating of maps and other literature

## Cell Phone

Each rating team is required to carry a cell phone with them at all times. If you have your own cell phone MRC will cover all calls associated with the use of this phone during working and commuting hours. MRC will provide a pre paid cell phone card or other arrangements will be made. If you do not have a cell phone, MRC will provide one. In all circumstances, MRC requires that we have access via a cell phone during working and commuting hours. If you are working in pairs, only one rater is required to have a cell phone. It is also required that you call MRC each morning to confirm that you are working that day and where you are. The best time to call is between 9 am and noon.

By signing this contract both parties agree to the above.

Rater

_____

Date: _____

MRC

_____

Date: _____

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